AD-A122 174 HIGH RESOLUTION STRATOSPHERIC WINDS FROM CHEMICAL SMOKE TRAIL EXPERIMENTS..(U) AIR FORCE GEOPHYSICS LAB HANSCOM AFB MA A F QUESADA 30 JUL 82 AFGL-TR-82-0209 1/1

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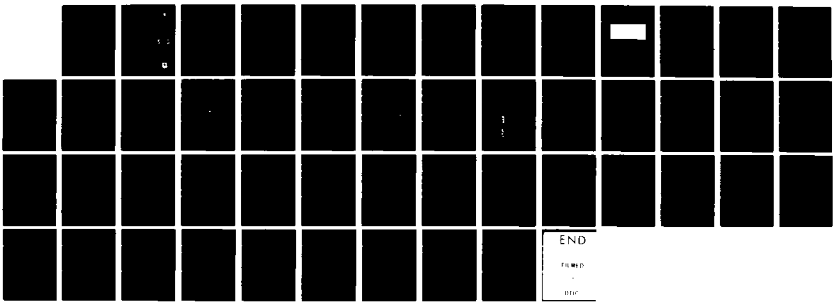

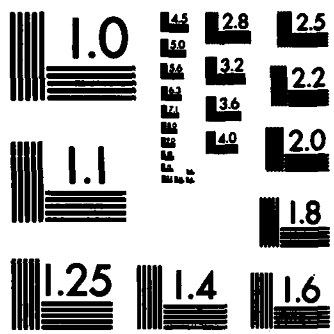

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AFGL-TR-82-0209
ENVIRONMENTAL RESEARCH PAPERS, NO. 785

High Resolution Stratospheric Winds From Chemical Smoke Trail Experiments at White Sands Missile Range and Wallops Island

ANTONIO F. QUESADA

30 July 1982

AERONOMY DIVISION PROJECT 6687
AIR FORCE GEOPHYSICS LABORATORY
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AIR FORCE SYSTEMS COMMAND, USAF

82 12 08 017

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Alva T. Stair, Jr.

DR. ALVA T. STAIR, Jr
Chief Scientist

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFGL-TR-82-0209 / 2. GOVT ACCESSION NO. AD-A122 474	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) HIGH RESOLUTION STRATOSPHERIC WINDS FROM CHEMICAL SMOKE TRAIL EXPERIMENTS AT WHITE SANDS MISSILE RANGE AND WALLOPS ISLAND	5. TYPE OF REPORT & PERIOD COVERED Scientific. Interim.
	6. PERFORMING ORG. REPORT NUMBER ERP No. 785
7. AUTHOR(s) Antonio F. Quesada	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Force Geophysics Laboratory (LKD) Hanscom AFB Massachusetts 01731	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62101F 66870506
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (LKD) Hanscom AFB Massachusetts 01731	12. REPORT DATE 30 July 1982
	13. NUMBER OF PAGES 51
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Stratospheric winds
Windshears
Chemical smoke trails

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes some recent improvements in the hardware and software used to measure photographic images of chemical smoke trails. It also presents measurements of winds and windshears for five experiments conducted at White Sands Missile Range and Wallops Island from 1973 to 1978. In addition, it discusses sources of error in the measurements and suggests means of reducing the errors to improve the vertical resolution of the wind and windshear profiles.

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Preface

The author wishes to thank Mr. C.A. Trowbridge, who conducted the film measurements and was responsible for much of the data reduction. He also thanks Ms. P.M. Bench for the preparation of the wind hodographs.

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High Resolution Stratospheric Winds From Chemical Smoke Trail Experiments at White Sands Missile Range and Wallops Island

1. INTRODUCTION

During the past several years, the Air Force Geophysics Laboratory (AFGL), Aeronomy Division (LKD) has conducted a number of rocket experiments for the purpose of releasing in a controlled manner a thick trail of titanium tetrachloride to make high resolution measurements of stratospheric winds and windshears. The measurements show jagged wind profiles consistent with the view that turbulence in the stratosphere occurs in thin layers that form randomly. There are structural features in the wind field, corresponding to high spatial frequencies, that lead to high shears over short vertical distances. These, in turn, are responsible for the onset of instabilities that grow into flattened turbulent regions, accounting for some of the vertical transport of tracers or pollutants injected into the stratosphere. Zones of intermittent mixing are thus created which, in the course of time, have an effect analogous to a diffusion process with a characteristic diffusion parameter. The present report is concerned with a general description of improved technique used to reduce and analyze the raw photographic data. It also presents the wind and windshear data gathered in the course of five rocket flights for which the triangulation has been found to be both consistent and reproducible. Finally, the report contains

(Received for publication 29 July 1982)

a discussion of some possible means of improving the accuracy and resolution of stratospheric winds computed from smoke trail data. The transport problem has been addressed by Dewan.[1]

2. COLLECTION OF RAW DATA

Chemical vapor or smoke trails dispensed from rockets have been used for over two decades to serve as visible tracers of atmospheric wind speed and direction. For stratospheric altitudes AFGL/LKD utilizes a mixture of titanium tetrachloride and water-methanol solution to form a thick trail that follows the motions of the wind field, and remains well defined for periods of several minutes. At later times the spreading of the trail may be used to estimate the magnitude and altitude dependence of the molecular diffusion coefficient. Details of payload configuration, and vapor release hardware are given by Vickery[2] and by Stokes et al.[3] The trails are photographed at regular intervals from the time of their injection into the ambient air until they drift out of the field of view of the cameras, or have become too tenuous to be photographed. In most cases this happens some fifteen minutes after the chemical smoke is vented from the rocket. Figure 1 shows the evolution of one trail (Trail "20 MAY") photographed from a triangulation station located about 25 km northwest of the launching site. The cameras are located at two or more ground stations chosen, when possible, to optimize the geometrical factors that influence the accuracy of the triangulation procedure that, subsequently, will reconstruct the successive positions of each point on the trail. We shall not dwell here on the characteristics of the cameras, the film, the exposure sequence or the film development needed to obtain negatives with sufficiently high contrast and low granularity to allow the triangulation to have a vertical resolution of 10 meters or better. These characteristics were listed in an earlier report by Quesada and Trowbridge.[4] In the following sections we shall describe changes and

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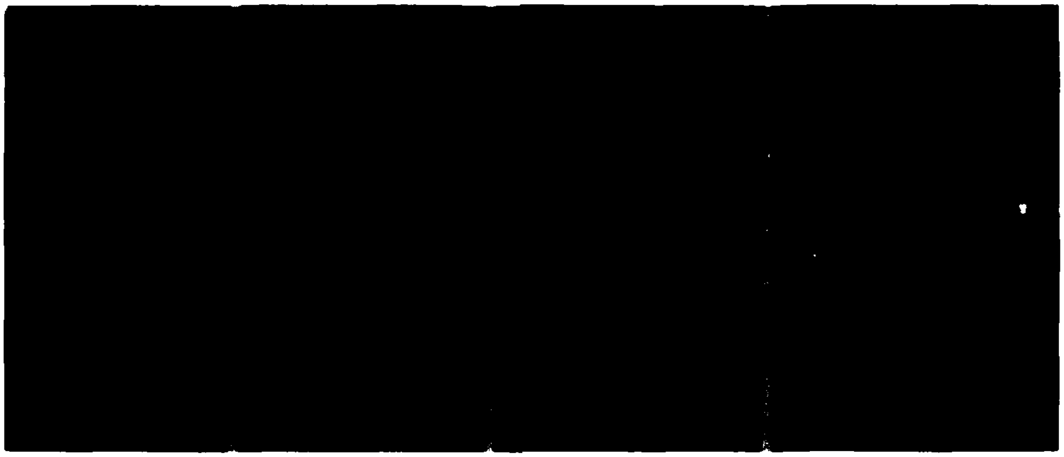
1. Dewan, E.M. (1981) Turbulent vertical transport due to thin intermittent mixing layers in the stratosphere and other stable fluids, Science **211**(No. 4486):1041-1042.
2. Vickery, W.K. (1975) Techniques for Depositing Visible Smoke Trails in the Stratosphere for Measurements of Winds and Turbulence, AFCRL-TR-75-0221, ADA013792.
3. Stokes, C.S., Murphy, W.J., and Smith, E.W. (1974) Experimental and Flight Evaluation of the Titanium Tetrachloride, Water-Methanol System for the Production of Smoke Trails, AFCRL-TR-74-0496, ADA006126.
4. Quesada, A.F., and Trowbridge, C.A. (1976) Analysis of Smoke Trail Photographs to Determine Stratospheric Winds and Shears, AFGL-TR-76-0243, ADA035504.

improvements introduced into the measurement of the trail and star background images, and in the triangulation procedure since publication of the report just referenced.

LAUNCH TIME (T_o) : 09 29 UT
APOGEE: 53.16 KM at T_o+119 s



T_o+128 s | +158 s | +218 s | +308 s

Figure 1. Evolution of Trail "20 MAY". Launched at Wallops Island on 20 May 1978, and photographed from Triangulation site near Pocomoke City, Maryland

2.1 Camera Orientation

Precise wind measurements depend on the accuracy with which the orientation of the camera is determined. To observe the motion of segments of a trail at a 50-km range at 10-meter intervals, we cannot tolerate angular errors that exceed 0.005 degree. Fortunately, when considerable pointing errors exist, their presence becomes apparent during the triangulation and velocity determination. They produce abrupt discontinuities in the trail position, and excessively large wind shears. Pointing errors are introduced by a variety of causes; for example, wind gusts that momentarily jar the cameras, accidental operator contact with the camera mount, differential expansion of the mount due to uneven heating, misidentification of dim stars in the calibration frames, film stretching due to malfunction of the film processor, and so on. Optimization procedures may be applied to reduce errors of this type, but they generally produce slightly different wind fields, and

we no longer use them. Vector procedures are used to determine the camera orientation and focal length from photographs of stars in the field of view of the cameras. They are described in various reports.[5,6] The vector procedures relate the star image positions in the film plane to their equatorial coordinates (right ascension and declination). The computations require knowing the time at which the calibration photograph was exposed and the camera site location on the Earth's surface (latitude, longitude, and height above mean sea level). These are taken from geodetic survey information with a target accuracy of 10 meters. Camera azimuth, elevation and horizontal tilt, and the precise focal length of the lens are determined with standard deviations consistent with the desired triangulation accuracy. For the cameras employed at the WSMR and Wallops Island experiments, standard deviations of 0.005 degree for the angles, and 0.01 cm for the focal lengths were routinely computed when 12 to 15 stars were used to determine the camera parameters. These deviations, translated to spatial positions, produce errors of the order of 5 meters at the (typically) 50-km range that separates the cameras from the center section of a stratospheric smoke trail.

2.2 Film Measurements

In principle, it is possible to use pairs of photographic negatives taken simultaneously from two separate ground stations to reconstruct the spatial location of the trail at the instant it was photographed. To do so, we must know the geographical location of the site and the orientation of each camera. The orientation of the cameras is usually defined by giving the azimuths and elevations of the optical axes. In addition, we must know the focal length of the lenses. In practice there are many pitfalls which may introduce small but unacceptable errors in the triangulation. Some have been discussed by Trowbridge,[7] together with means to minimize or compensate for their effects. The basic principle is to measure very accurately the coordinates of closely spaced points on the center-line of the trail image. To establish a reference coordinate system common to all photographs, fiducial marks are recorded on every frame when the trail is photographed. Since several hundred to a few thousand coordinate pairs must be measured on each frame, a semiautomatic, computer controlled densitometric system was designed and built to measure, digitize, and record these coordinates on magnetic tape. The instrument and the

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5. Quesada, A.F. (1971) Application of Vector and Matrix Methods to Triangulation of Chemical Releases in the Upper Atmosphere, AFCRL-71-0233, AD729448.

6. Quesada, A.F. (1975) Vector Evaluation of Triangulation Camera Parameters From Star Photographs, AFCRL-TR-75-0451, ADA019655.

7. Trowbridge, C.A. (1982) Identification of Requirements for Atmospheric Data, AFGL-TR-82-0015, ADA113640.

software needed to make it operational were described by Trowbridge and Andrus.[8] Recently, a series of modifications was needed to reestablish the operational status of the instrument, many of whose digital components were over 10 years old and could not be replaced or repaired when they malfunctioned. The instrument is a video based system with an encoded stage that transports the film, and upon command from the computer aligns the optic axis of the video camera with any point of the photographic negative under examination. Electronics for processing the input signals were designed to provide adjustable operating ranges of approximately 0.5, 1.0, 1.5, and 3.0 optical density units (D). These ranges may be shifted to cover any portion of the total useful range (4D) of the densitometer. The system, shown diagrammatically in Figure 2, is unique in that gross alignment of features to be measured may be accomplished using distances and densities from the off-axis video. Fine positioning and measurement of the densities of desired features are performed on the video axis as the film is aligned with the axis by the moving stage. Thus, effects of field curvature, distortion, and system photometric nonuniformity (vignetting) are essentially removed. Final coordinate information is obtained only from the extremely accurate stage drive and encoders. The maximum error is less than 10 μm over a 150-mm total displacement, with repeatability and precision better than 2 μm.

The digitization procedure begins with the alignment of the film frame on the scanner, using two fiducial markers to set one axis of the film coordinate system perpendicular to one axis of the scanning system. A third fiducial is then used to determine one point of the second axis of the film coordinate net, whose center coincides with the camera optical axis. The trail digitization proper starts with the introduction of a trail "skeleton," that is, a series of guide points widely spaced along the trail image which are entered manually using a joy-stick control to transport the film to the desired positions. These points provide starting and ending points for the curve following software of the computer system, and allow both accurate determination of the coordinates of the trail axis, and motion in the proper direction along the trail, with minimal operator intervention. Proper direction along the trail is crucial, particularly at late times when very frequently the trail image shows closed loops that must be traversed in the correct direction, in order to avoid serious discontinuities in the triangulation.

Star calibration photographs require long exposures (2 min) and each star image is a narrow arc segment on the film, resulting from the Earth's rotation during the exposure time. The coordinates of the center point of each track (corresponding to a time midway between the beginning and end of the exposure) are found by

8. Trowbridge, C.A., and Andrus, W.S. (1978) An Automated Coordinate Measuring System for Smoke Trail Photographs, AFGL-TR-78-0231, ADA062485.

first digitizing and storing coordinates and densities measured on the axis of the arc. Density and position information are then transferred to the computer, which identifies the end points of the axial arc and calculates the position of its center. Star tracks have been found to provide star locations with a higher precision than obtained from the point images produced by short exposures.

2.3 Trail Position and Horizontal Velocity Measurements

The triangulation program uses the coordinates of the trail centerline as viewed from two sites, the site geodetic coordinates, and each camera orientation which, as explained previously, is derived from the star calibration photographs. In principle, this is sufficient to reconstruct the spatial location of the trail. We have implemented the vector-matrix techniques described in References 5 and 6 to create a software package that improves significantly the ease and speed of the triangulation. In practice, computational problems, such as described by Trowbridge et al,[9] may degrade the accuracy of the results over short sections of the trail and reduce the vertical resolution by a factor of approximately 2. One reason is that the trails generally have no features that can be uniquely identified on photographs taken simultaneously from widely separated locations. Triangulation is, therefore, performed using an iterative approach that minimizes discrepancies in the dihedral angle computed from each site to a given point on the trail. The quantity which is minimized, and serves as a figure of merit, is the angular mismatch between the normals to the dihedral planes, each of which is defined by the common line through the two observation sites and the lines-of-sight to the points that we wish to match. The spatial position of the trail (altitude, latitude and longitude) is determined, assuming a spherical Earth, from the intersection (or near intersection) of the line-of-sight vectors for points that have been matched. The data are stored for later use by the computer program that calculates the horizontal velocities from trail positions corresponding to known time intervals.

Improvements in the triangulation procedure were obtained by a change in the dihedral angle tolerances that resulted in point matching with a much higher accuracy. With tigher tolerances, about 50 percent of the digitized points are discarded during the triangulation. This means that the altitude resolution finally obtained is somewhat less than 10 m, although the raw data were digitized with about a 5-m resolution. Measures of "goodness of fit" for the triangulation other than control over the dihedral angle mismatch, such as average film plane mismatch and average separation vector, have also been improved by a factor of 10. There is also excellent agreement between the velocity profiles calculated from triangulation site number 1 against site number 2, or the reverse pairing.[7]

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9. Trowbridge, C.A., Kofsky, I.L., and Johnson, R.H. (1978) Recording and Analysis of Optical Data From Stratospheric Dynamics Experiments, AFGL-TR-78-0015, ADA054013.

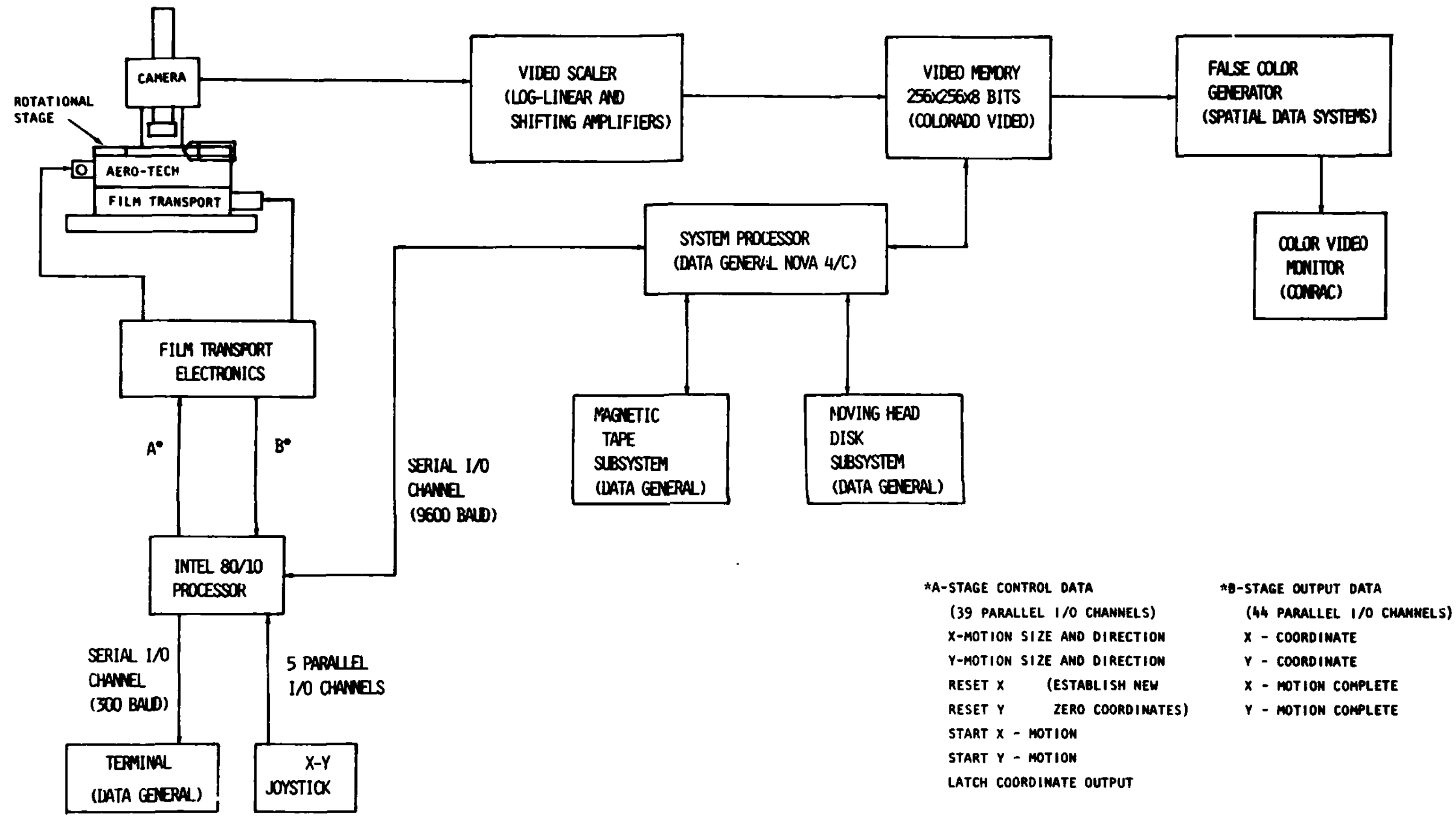

Figure 2. Block Diagram of the Coordinate Measuring System

Further study of the change in the triangulation procedure, that is, insisting that the dihedral angular mismatch be extremely small, has shown that it very effectively preserves trail continuity. The larger values of dihedral angle mismatch previously tolerated permitted an accumulation of error to occur, and grow up to a limit. This was followed by several consecutive mismatches, and then again by error buildup. The resulting sawtooth error generated small discontinuities (and occasionally larger ones) that proved to be troublesome when the shears were computed. Owing to the smaller percentage of matches obtained when a tight dihedral angle tolerance is introduced, some resolution is lost. We have estimated that in order to maintain an average 10-m vertical resolution, the raw data must be digitized at intervals of about 12 μm (on the film plane) for a 50-km range. The exact value depends on the degree of distortion of the trail induced by the wind field. By reducing the separation between consecutive scans to 12 μm, we will substantially increase the time required to digitize each frame. A possible reduction in the digitization workload has been suggested in Reference 7. It requires digitizing the films from one site at the nominal 10-m resolution, and the other site at a higher resolution.

With introduction of the change in the triangulation procedure, the major source of error for determining trail positions is the precision with which the camera orientation can be measured. Better measurements can be made if one records the start and end times of the exposure with an accuracy of 0.1 second. An increase in the number of stars used (currently 10 to 15) and a finer digitizing interval (typically 20 μm) could also contribute to more precise camera orientation parameters.

The next step of the smoke trail method is to determine winds from the point trail positions. The trail position data from the triangulation are interpolated at equal altitude intervals by either a cubic polynomial or a cubic spline. Then, a least-squares analysis of position versus time is introduced to derive average horizontal velocities. Ordinarily, we can use a sequence of 4 to 6 frames spanning an interval of about 2 to 3 minutes. Minor changes were made to the velocity routines to correct inconsistencies on the assignment of the time separation for sequential trail positions. The velocity values were unaffected by the change, but the uncertainty associated with each velocity was reduced by nearly a factor of 2.

3. WIND AND WINDSHEAR RESULTS

The wind measurements which will be presented in this section were made from raw data collected from 1973 to 1978. In Appendix A, we list the trails and star calibrations whose images were digitized. For the trails, some features of the

smoke release are indicated. Some of the trails consist of up to 10 segments. By breaking up the trail in this manner, we can unambiguously identify common points on different views of the trail, and thus facilitate the operation of the triangulation package. Although the rocket vehicle and the smoke release mechanism after 1973 were selected to cover the altitude range 15 to 50 km, it is often impossible to use the entire length of the trail. For example, sometimes the camera viewing angles are optimum for the lower sections of the trail, but are much less adequate for the upper portions, whose images show multiple overlapping of segments or extreme foreshortening that obliterates structural details, or does not permit triangulation with the required resolution.

The following pages contain the results of our measurements in graphical form. In Appendix B we list a typical output of the triangulation and wind programs. A complete data file for all trails is available on magnetic tape.

For the winds, we have computed the East-West, North-South components, and the resultant wind speed. We have also computed some hodographs. In the shear diagrams we have displayed the values of

$$S = \sqrt{\left(\frac{V_{E-W}}{\Delta z}\right)^2 + \left(\frac{V_{N-S}}{\Delta z}\right)^2}$$

as a function of altitude.

We note that, in general, a hodograph covering an altitude interval of many kilometers in the stratosphere, is usually of limited value, because of the convoluted nature of the curve traced by the tip of the vector wind. This is well illustrated in Figure 20, where altitude ranges from 18 to 33 km. On the other hand, if the altitude interval extends over a few kilometers, as in Figure 19, the hodograph can be very informative.

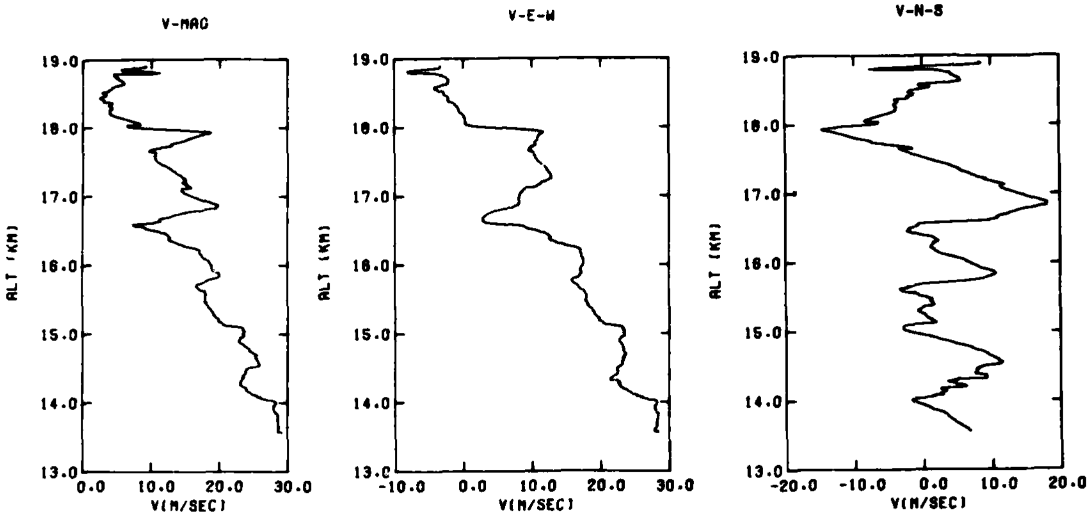

Figure 3. Wind vs Altitude for Trail "FLORA". Rocket launched at WSMR on 4 June 1973 at 1230 UT

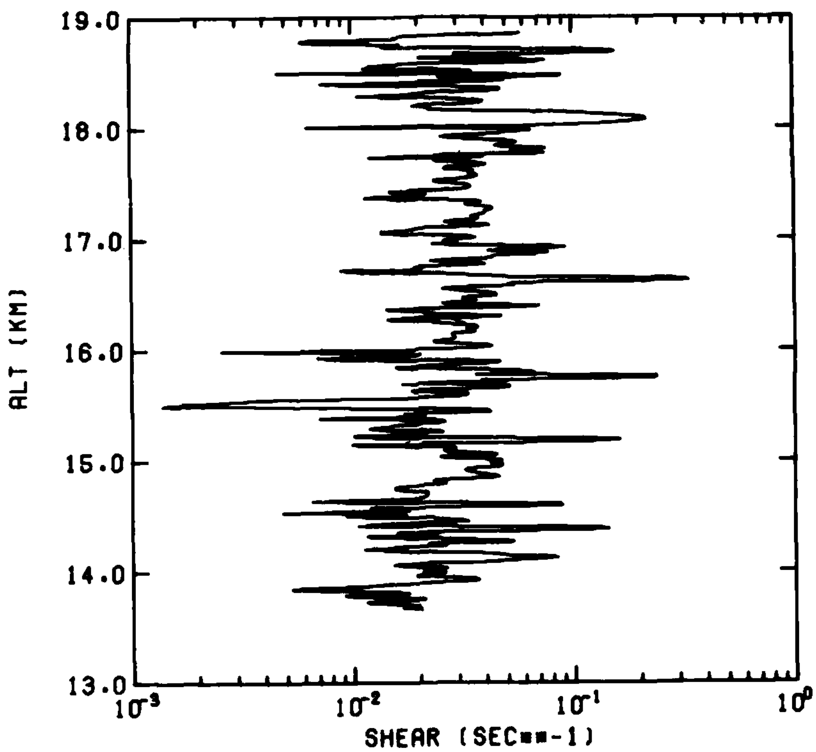

Figure 4. Windshear vs Altitude for Trail "FLORA"

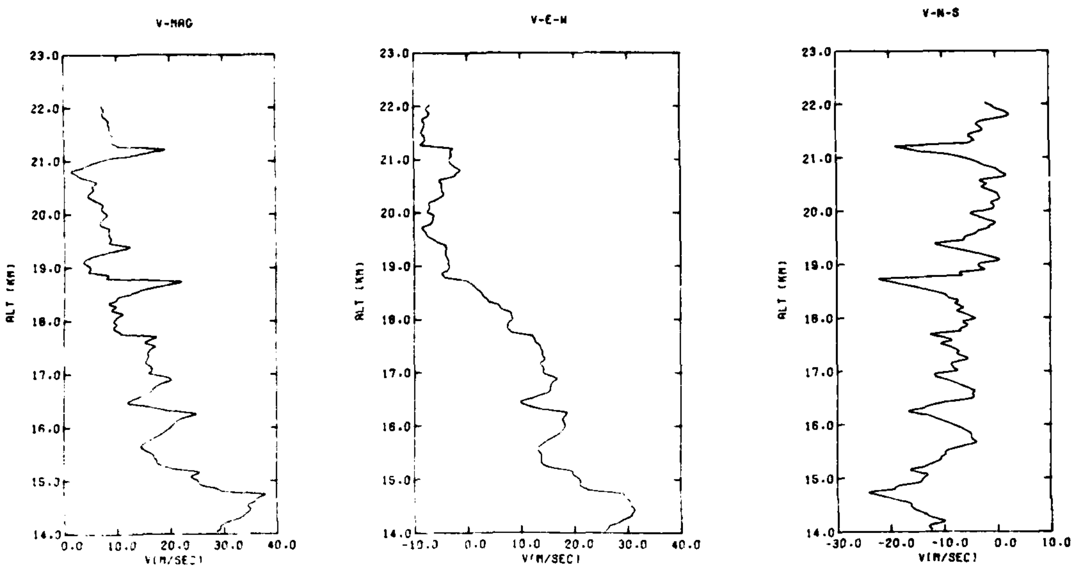

Figure 5. Wind vs Altitude for Trail "IRIS". Rocket launched from WSMR on 6 June 1973 at 1200 UT

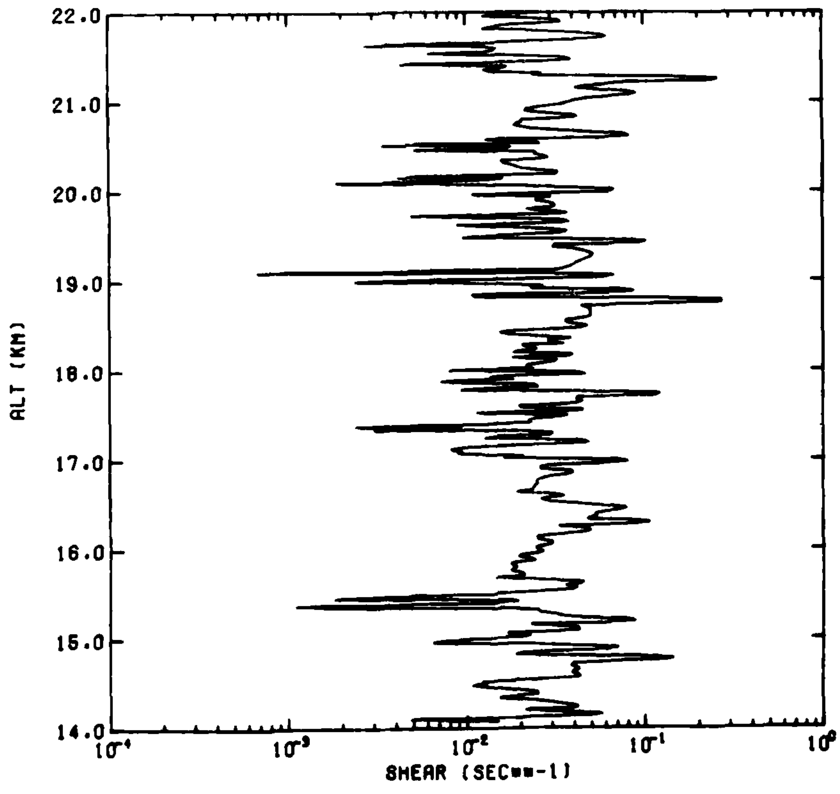

Figure 6. Windshear vs Altitude for Trail "IRIS"

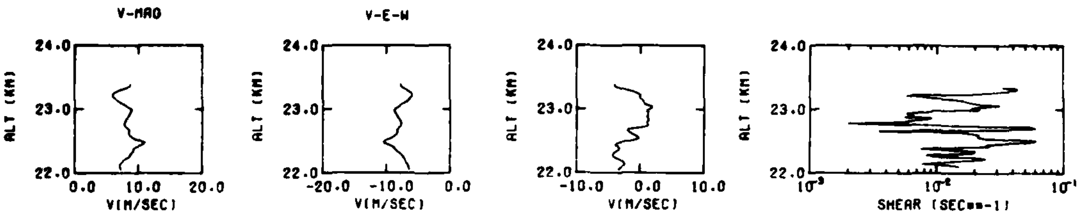

Figure 7. Wind and Windshear for Upper Section of Trail "IRIS"

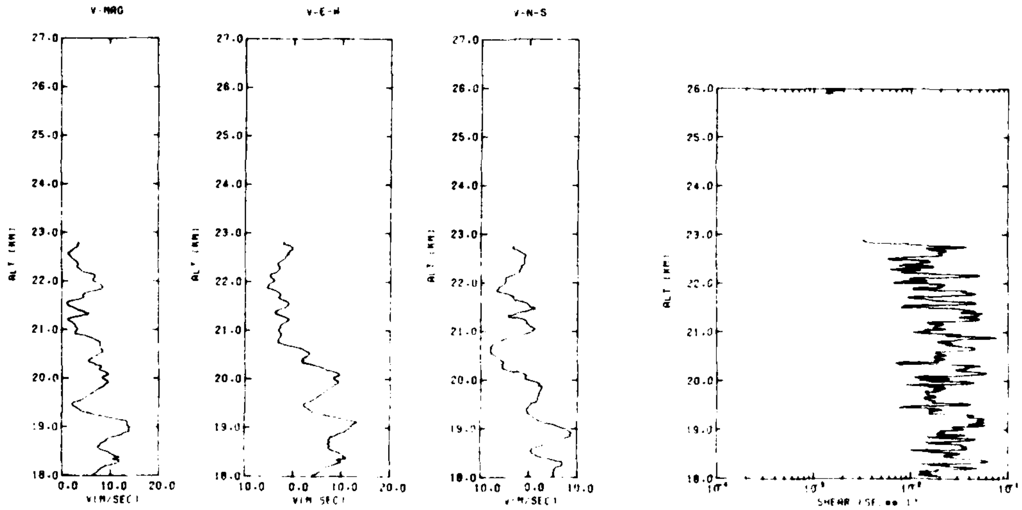

Figure 8. Wind and Windshear vs Altitude for Lower Section of Trail "22 APRIL". Rocket launched from WSMR on 22 April 1977 at 1215 UT

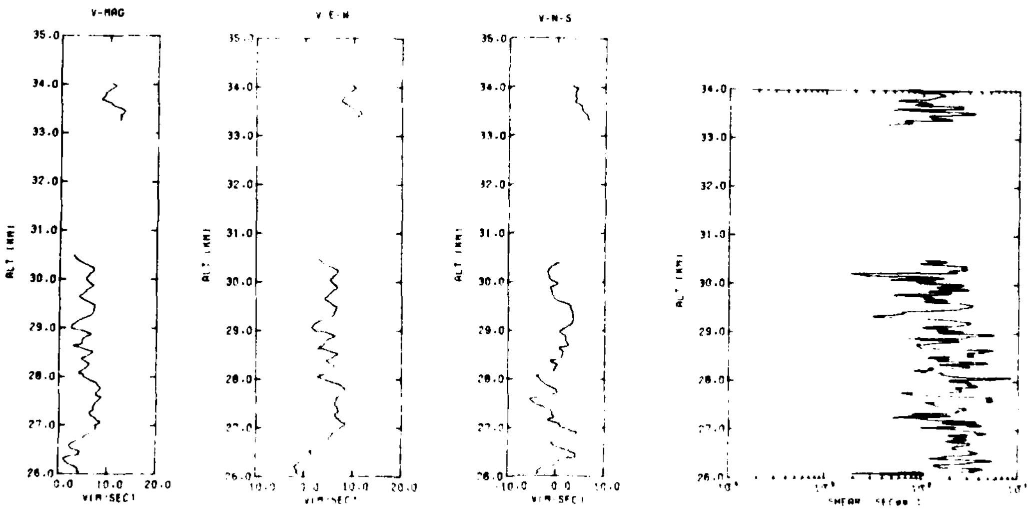

Figure 9. Wind and Windshear vs Altitude for Midsection of Trail "22 APRIL"

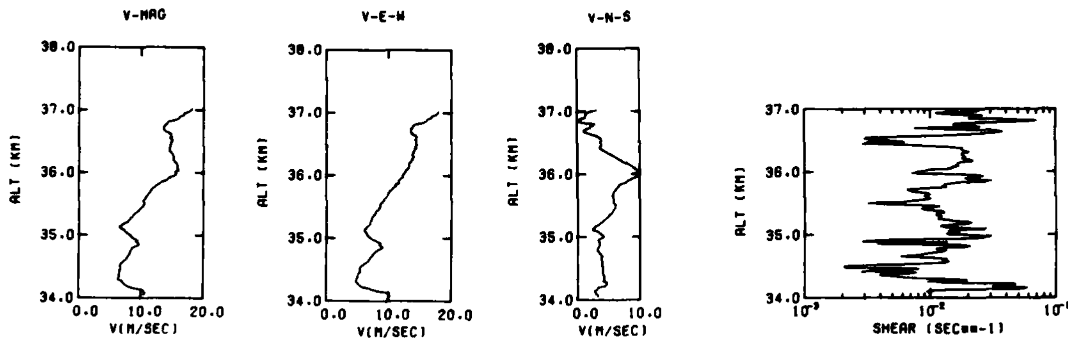

Figure 10. Wind and Windshear vs Altitude for Upper Section of Trail "22 APRIL"

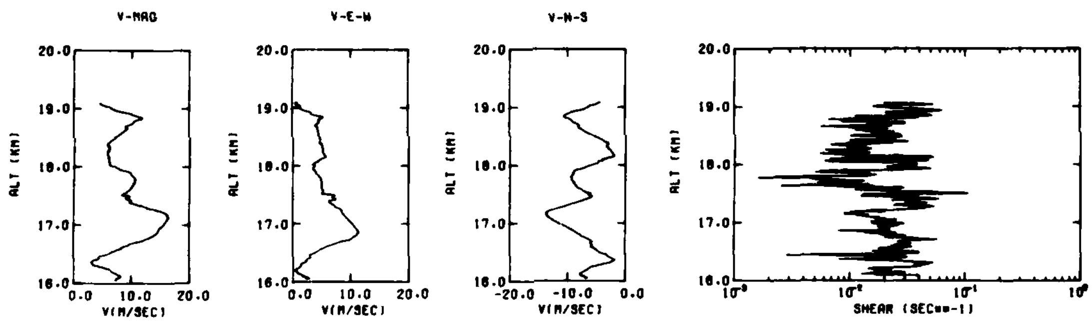

Figure 11. Wind and Windshear vs Altitude for Lower Section of Trail "20 MAY". Rocket launched from Wallops Island on 20 May 1978 at 0929 UT

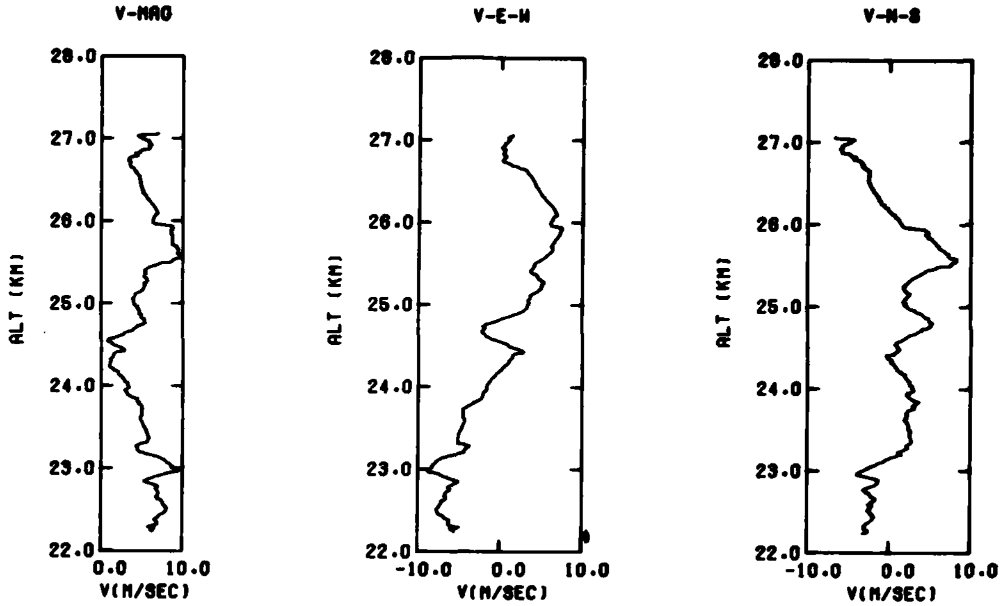

Figure 12. Wind vs Altitude for Mid-lower Section of Trail "20 MAY"

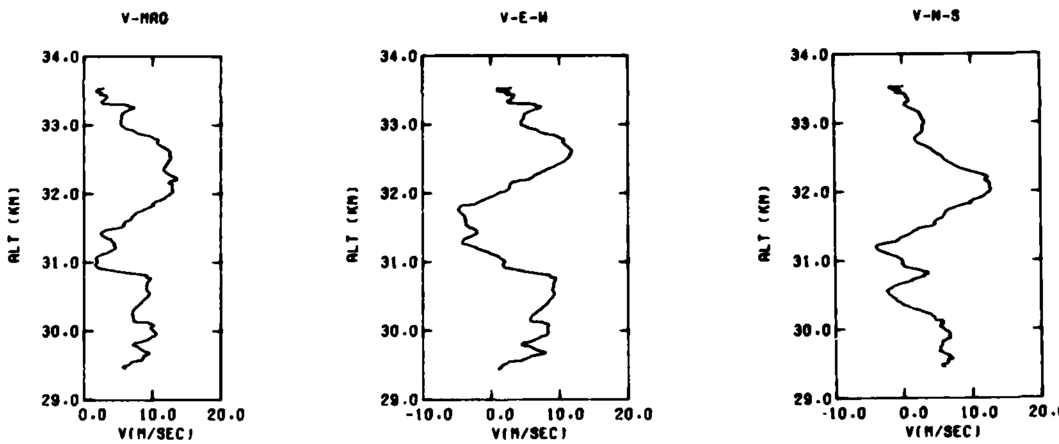

Figure 13. Wind vs Altitude for Mid-upper Section of Trail "20 MAY"

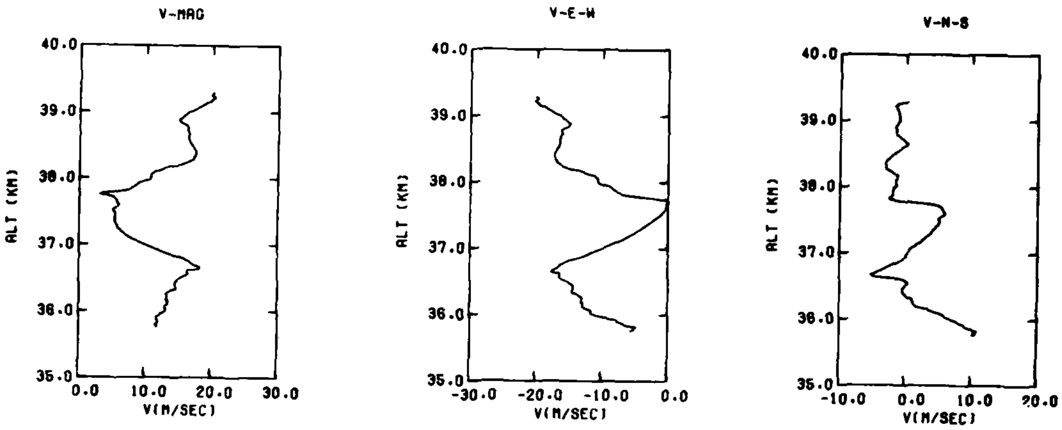

Figure 14. Wind vs Altitude for Upper Section of Trail "20 MAY"

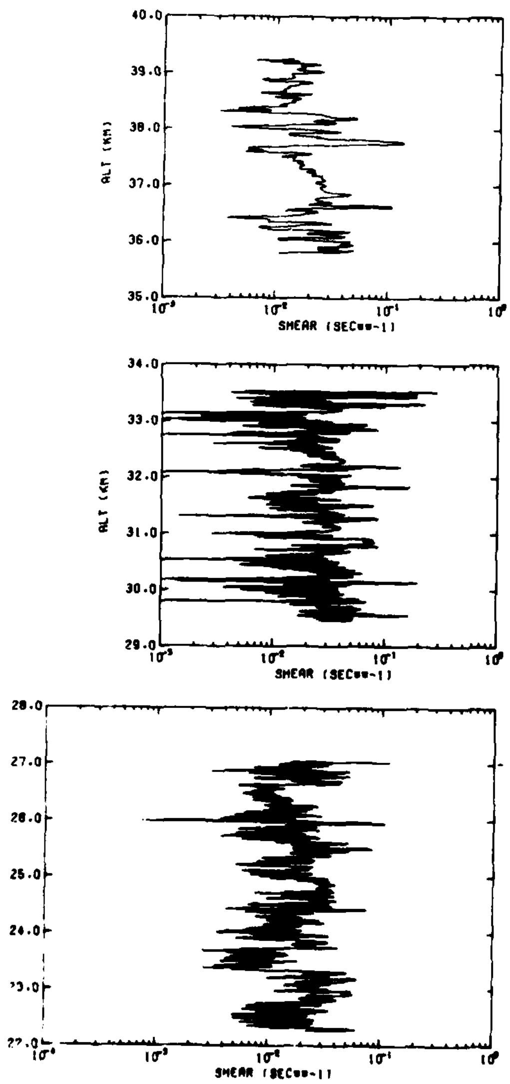

Figure 15. Windshear vs Altitude for Mid- and Upper Sections of Trail "20 MAY"

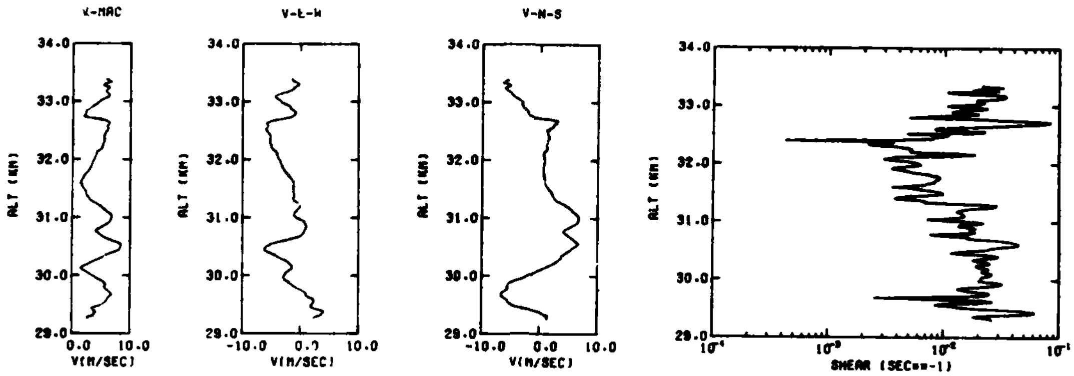

Figure 16. Wind and Windshear vs Altitude for Trail "22 MAY". Rocket launched from Wallops Island on 22 May 1978 at 0927 UT

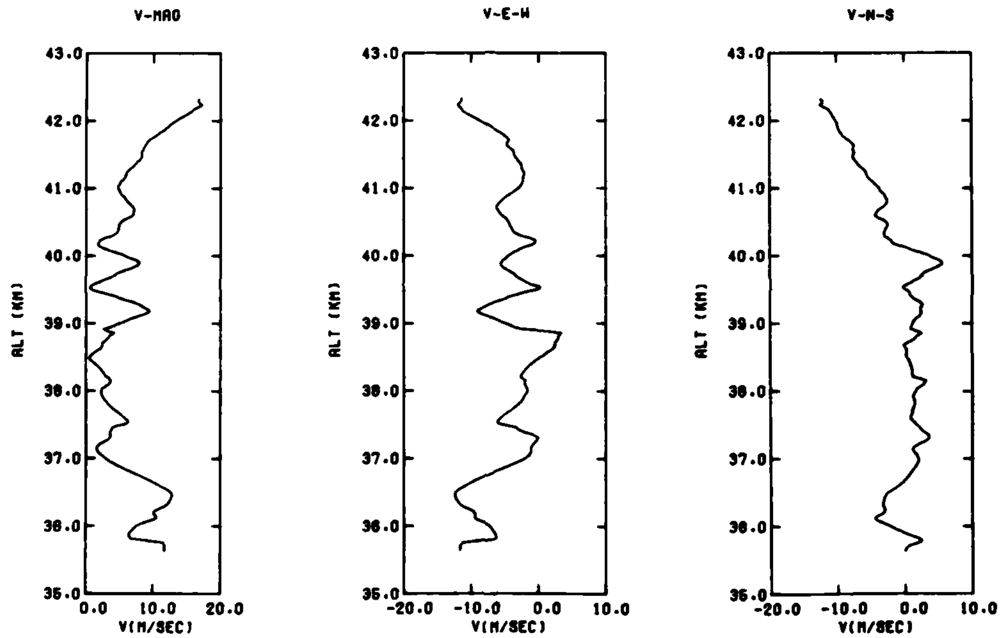

Figure 17. Wind vs Altitude for Upper Section of Trail "22 MAY"

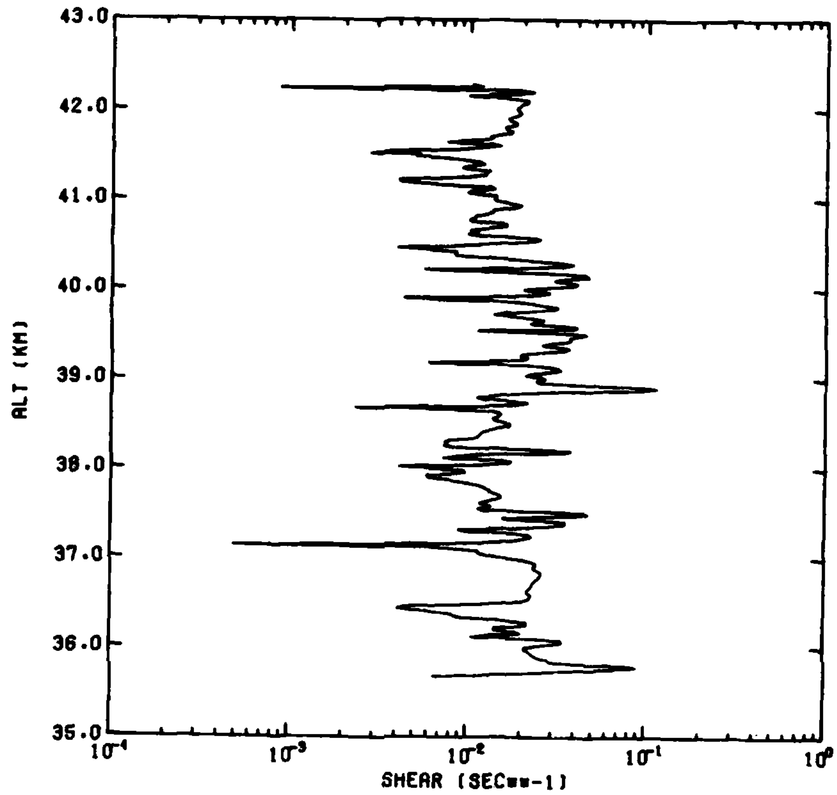

Figure 18. Windshear vs Altitude for Upper Section of Trail "22 MAY"

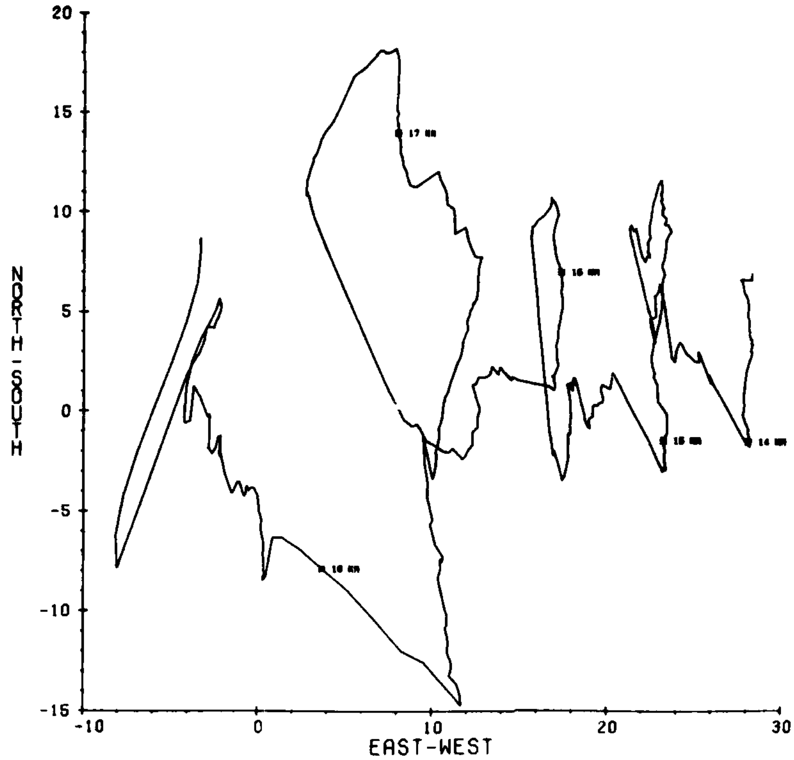

Figure 19. Hodograph for Trail "FLORA"

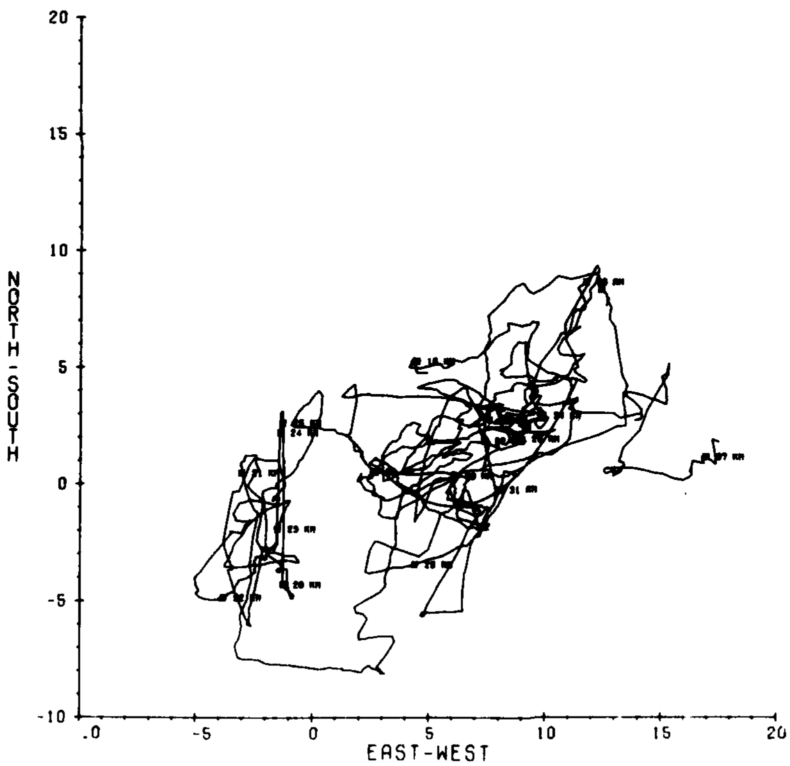

Figure 20. Hodograph for Trail "22 APRIL"

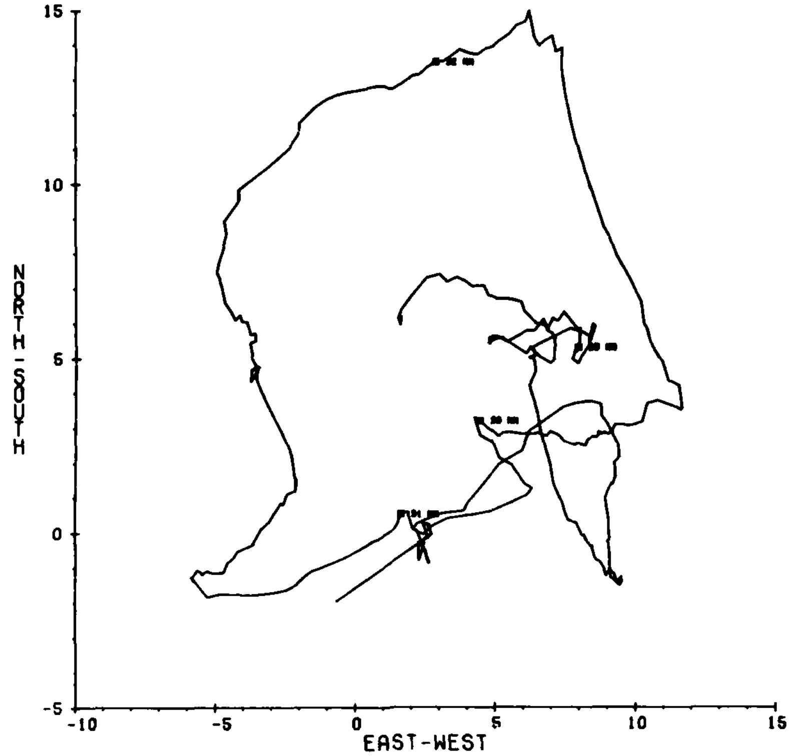

Figure 21. Hodograph for Trail "20 MAY"

4. DISCUSSION

Measurements of stratospheric winds and windshears with high vertical resolution show that the dynamic structure of the stratosphere is very complex. A salient feature is the presence, in nearly every case, of a variety of motions corresponding to scales of tens of meters, and varying in relatively short times, superimposed on longer time and spatial motions that represent the response to such factors as tidal forces and diurnal heating. The fine scale motions are particularly apparent when a comparison is made of simultaneous, or nearly simultaneous, soundings of the stratosphere by means of techniques that have widely different vertical resolution. Figures 22, 23, and 24 show smoke trail measurements done during an earlier programe at WSMR, and rawinsonde profiles at essentially the same time. Lack of total agreement between the rawinsonde and the smoothed smoke trail profiles is to be expected because of time differentials, and the impossibility of matching the paths of the rawinsonde balloon and the smoke trail rocket. The comparison shows, however, that gross structural features of the wind field persist over time intervals of minutes and horizontal distances of kilometers.

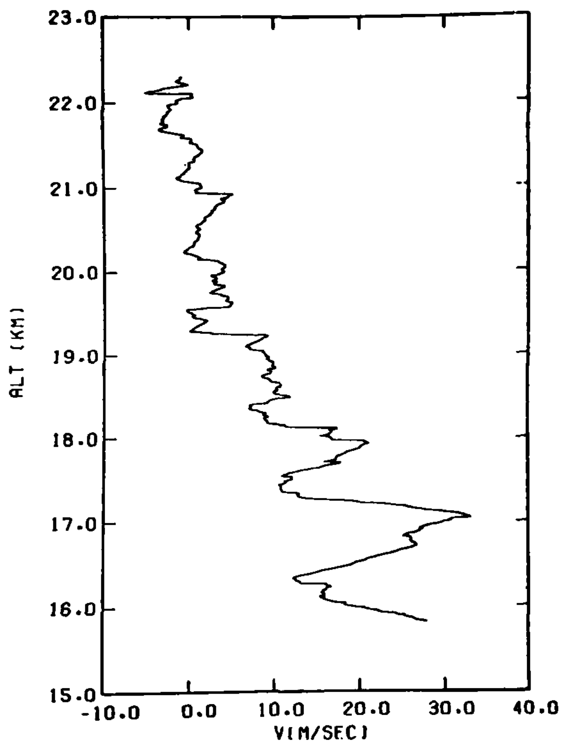

Figure 22. Easterly Velocity Profile Determined From Release "APPOLON" by the Smoke Trail Method

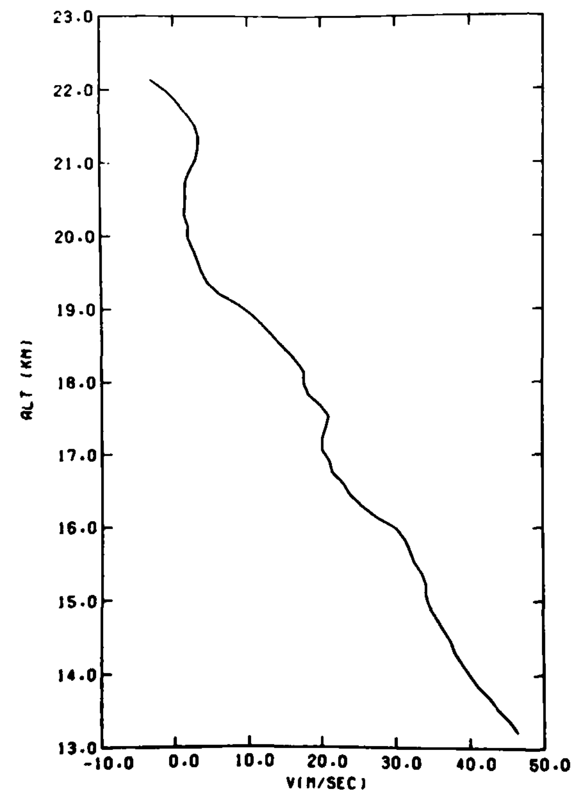

Figure 23. Easterly Velocity Profile at Time of "APPOLON" Determined by Rawinsonde Tracking

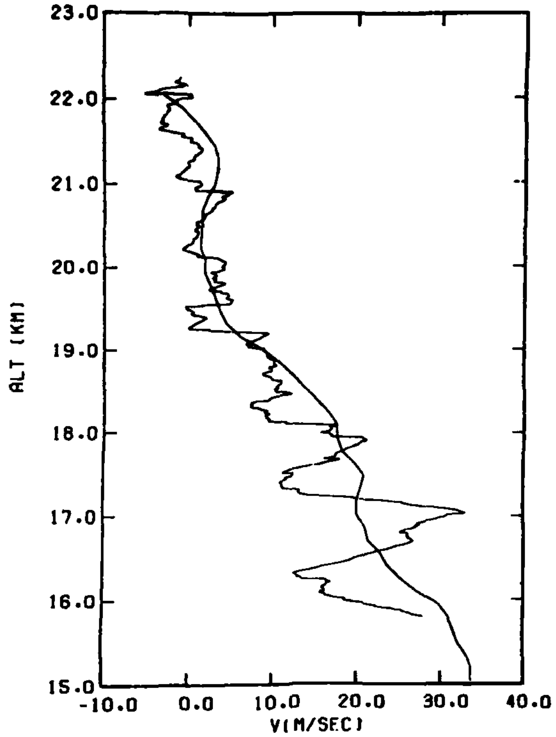

Figure 24. Superposition of Figures 22 and 23 to Compare Altitude Resolution

One dash for the trail of 20 May 1978 was redigitized using a raster increment of 12 μm (rather than the more common 48 μm), in order to determine whether the denser positional data would improve the accuracy and vertical resolution of the winds. When the triangulation results were scrutinized, it was clear that the average altitude increment had been reduced by approximately a factor of 3. However, no improvement was observed in the standard deviation of the resultant winds. It was evident that improper pairing of points from each site was responsible for discontinuities in the triangulation that led to spurious shears. Repeating the triangulation with a tigher tolerance for the dihedral angle did not improve the results. We have concluded that the appearance of artificially high shears is often caused by attempts to reduce data with a resolution finer than the natural limit imposed by the precision with which the camera orientation and focal length are computed. For the measurements given in this report, this limit lies between 10 and 15 meters. On the other hand, smoke trails afford in practice, as our measurements demonstrate, a technique for the determination of horizontal winds at intervals of 10 meters with

a standard deviation in the velocity that averages 50 cm per sec. These numbers apply to large sections of the trails. There are sometimes short intervals along the trails where the measurements are not that good. Loss of vertical resolution by a factor of 2, and wind velocities with errors exceeding 1 m per sec occur when the trail is embedded in a wind field that aligns a short section of it with a line-of-sight from one of the cameras. In such cases, there is a one-to-many point correspondence for the images recorded at each of two sites, and vertical resolution as well as wind velocity are correspondingly degraded. In principle, it is possible to refine the measurements of the trail images to provide sampling of the wind field at vertical intervals of 2 meters, and have the granularity of the film set the limit for the fine scale structure. To realize this improvement, however, it would be necessary to increase the accuracy of the camera orientation and focal length determination, which at present, limits the resolution to no better than about 10 meters. Obtaining higher accuracy for the camera parameters does not appear unsurmountable. We estimate, for example, that a factor of 2 in vertical resolution can be gained by increasing the accuracy in timing the beginning and end of a star calibration exposure to 0.1 sec, and reducing the error in synchronization of cameras at different sites to a comparable value. At present both of these timing errors vary between 1/2 and 1 sec.

Further analysis of the data presented in this report is in progress. It will contribute to the study of statistical properties of stratospheric wind fields, and will form the basis for forthcoming reports.

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Appendix A

Summary of Data Digitized

Summary of Data Digitized

Event Name or Date	Frame	Site	Data
FLORA	14	Seehorn	Single Trail
4 Jun 73	17	Seehorn	13-19 km
	19	Seehorn	
	21	Seehorn	
	23	Seehorn	
	14	Hotel	
	17	Hotel	
	19	Hotel	
	21	Hotel	
IRIS	65	Seehorn	Single Trail
6 Jun 73	66	Seehorn	14-23 km
	67	Seehorn	
	68	Seehorn	
	65	Hotel	
	66	Hotel	
	67	Hotel	
	68	Hotel	

Event Name or Date	Frame	Site	Data
22 Apr 77	81	T5	Dashed Trail 18-37 km
	82	T5	
	83	T5	
	84	T5	
	81	Two Buttes	
	82	Two Buttes	
	83	Two Buttes	
	84	Two Buttes	
	85	Two Buttes	
20 May 78	2	Pocomoke	Dashed Trail 16-44 km
	3	Pocomoke	
	4	Pocomoke	
	5	Pocomoke	
	6	Pocomoke	
	7	Pocomoke	
	8	Pocomoke	
	9	Pocomoke	
20 May 78	2	Wachapreague	
	3	Wachapreague	
	4	Wachapreague	
	5	Wachapreague	
	6	Wachapreague	
	7	Wachapreague	
	8	Wachapreague	
	9	Wachapreague	
20 May 78	4	Pocomoke	High Resolution Scans of Dash 3 - Maximum Increment = 12 μm
	5	Pocomoke	
	6	Pocomoke	
	7	Pocomoke	
	4	Wachapreague	
	5	Wachapreague	
	6	Wachapreague	
	7	Wachapreague	
22 May 78	41	Pocomoke	Dashed Trail 29-42 km
	42	Pocomoke	
	43	Pocomoke	
	44	Pocomoke	
	45	Pocomoke	
	46	Pocomoke	
	47	Pocomoke	
	41	Wachapreague	
	42	Wachapreague	
	43	Wachapreague	
	44	Wachapreague	
	45	Wachapreague	
	46	Wachapreague	
	47	Wachapreague	

Summary of Star Frames Digitized

Event Name or Date	Frame	Site	Maximum Error (Along Star Track)
FLORA 4 Jun 73	9 11	Hotel Seehorn	± 24 μm
IRIS 6 Jun 73	63 63	Hotel Seehorn	± 20 μm
22 Apr 77	99 99	T5 Two Buttes	± 24 μm
20 May 78 22 May 78	1 20 1	Wachapreague Wachapreague Pocomoke	± 20 μm

Appendix B

Output of Position and Velocity Programs for Trail "IRIS"

The following pages contain a fraction of the output of the position program and the entire output of the velocity program for trail "IRIS."

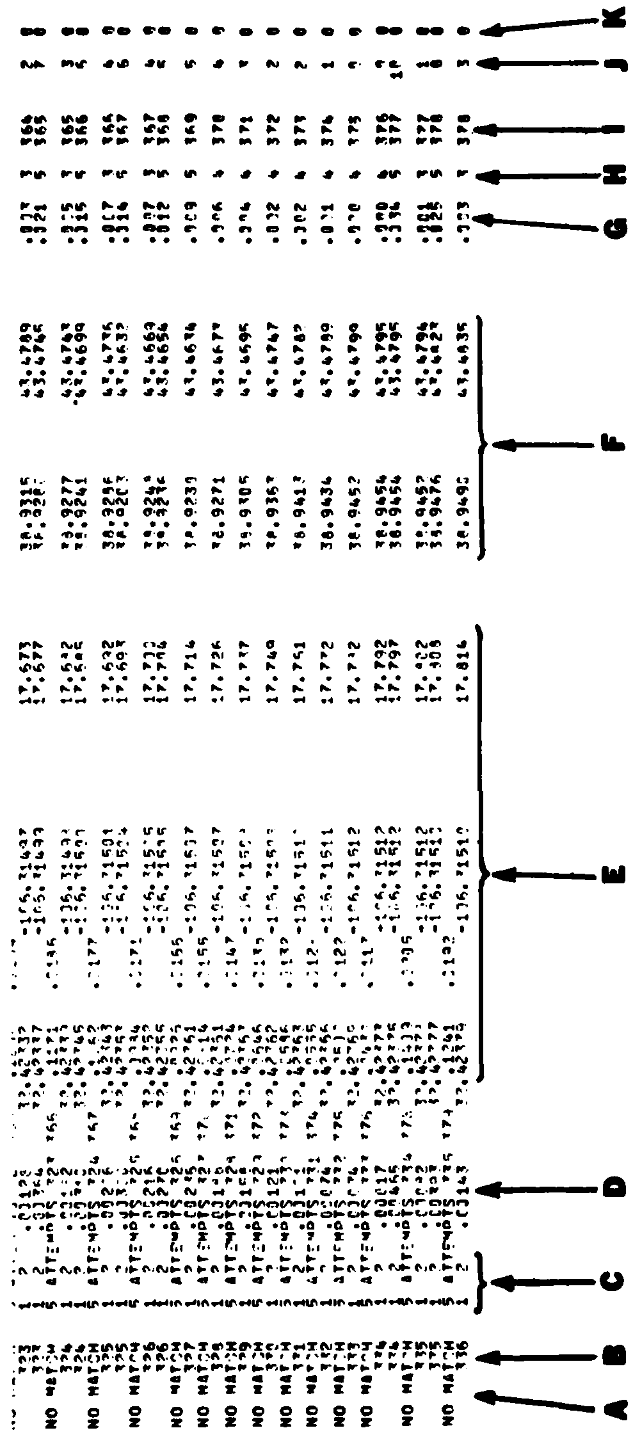
Part I. Sample Output of the Triangulation Program

The listing of the position program displays the following information:

A. First Entry — If a match is found for a point belonging to site 1, it is blank. If no match is found the program writes a shortened line that begins with the words "NO MATCH" and then the number of points on the file corresponding to site 2 that it tried for a match "(#) ATTEMPTS". This is followed by the point numbers for which the best match could be established when the program examined in succession points from the file for site 2. The match, however, does not lead to a dihedral error within tolerance, and is rejected. Next the program writes the separation vector (meters) corresponding to this best match and the dihedral angular discrepancy in radians × 1, 000, 000.

B. Second Entry — The point number on the file of film plane coordinates corresponding to site 1 that is to be matched to some point on the file for site 2.

C. Third and Fourth Entries	Site numbers. The triangulation program uses two sites at a time, but if more than two stations were active and provided photographic data one can use, for example, site 1 and site 2, or, site 1 and site 3, and so on.
D. Fifth Entry	Numerical value of discrepancy (centimeters) when the point on site 1 which has just been matched is projected on the film plane of site 2.
E. Sixth, Seventh and Eighth Entries	Latitude and longitude (degrees) and altitude (kilometers) above mean sea level for the point on the trail for which a match has just been established.
F. Ninth and Tenth Entries	Ranges to each site (kilometers) for the point on the trail whose coordinates are given in E.
G. Eleventh Entry	Figure of merit for the present match. It represents the dihedral angular error (radians) $\times$ 1,000,000.
H. Twelfth Entry	Number of points for file 2 that were tried before a match is found. If the first attempt leads to a dihedral angle within tolerance, the program does not jump to the next point, but rather tries a few neighboring points from site 2 to determine whether they result in smaller dihedral discrepancies, and then takes as a match the pairing with minimum dihedral error.
I. Thirteenth Entry	Number of the point on file from site 2 that matched the point on file from site 1 whose number is listed in B.
J. Fourteenth Entry	Magnitude (meters) of closure error of lines-of-sight from the 2 stations, that is, length of vector perpendicular to both line-of-sight vectors.
K. Fifteenth Entry	Flag used to identify printing sequence selected for each line of output.


A
B
C
D
E
F
G
H
I
J
K

```
NO. OF FRAMES, MAX S VECTOR, MAX TIMED FIGURE OF MERIT      4      .015      .8000E-08

                                             IRIS  06JUN73SHORN  32.75576396N. LAT.-106.48671223W. LONG.
                                            1349.0CMETERS
  .563511  -1.959544
.174980'33E+04
-.15240383E+04-.51496279E+04 .34317597E+04
-1.85956     .56961  -1.85956
  FOCAL LENGTH = 17.903 CM

  AZ        EL         TILT
156.57715  16.17737    .21745
  2.69748    .23235    .33398

                      RIGHT ASCENSION OF CAMERA =  -1.136
                      DECLINATION OF CAMERA = -35.517
                      ROTATION OF THE FILM PLANE =    .217

          AZIMUTH = 156.577          ELEVATION = 16.177          SIDEREAL TIME = 1.308

               SIEHORN   F965        111.11  06/06/73  IRIS

                                     574 NPTS

                                             IRIS  06JUN73HOTEL  32.72917222N. LAT.-106.21349618W. LONG.
                                            1219.0CMETERS
  .563148  -1.453775
.12191193E+04
-.14939387E+04-.51593253E+04 .34292.79E+04
-1.55379     .56315  -1.25379
  FOCAL LENGTH = 17.933 CM

  AZ        EL         TILT
197.61992  21.21573   -.44552
  3.44912    .37029   -.33779

                      RIGHT ASCENSION OF CAMERA = -51.109
                      DECLINATION OF CAMERA = -73.555
                      ROTATION OF THE FILM PLANE =   -.445

          AZIMUTH =-162.390          ELEVATION = 21.215          SIDEREAL TIME = 1.308

               HOTEL     F965        111.11  06/06/73  IRIS

                                     573 NPTS
```

STEHORN F255 111.11 06/05/73 IPIS

HOTEL F255 111.11 06/06/73 IRIS

NO MATCH	532	ATTEMPTS	1	1	.9559	.1320									
NO MATCH	5	ATTEMPTS	2	1	.5519	.1399									
NO MATCH	7	ATTEMPTS	3	1	.2719	.1277									
NO MATCH	9	ATTEMPTS	4	1	.9093	.0159									
5	1	2	.00171		32.41351		-136.31482	14.012	37.9913	42.6925	.005	3	1	3	0
NO MATCH	5	ATTEMPTS	5	2	.3672	.0138									
6	1	2	.00216		32.41355		-136.31481	14.015	37.9876	42.5993	.007	3	1	4	0
6	1	2	.00262		32.41355		-136.31490	14.021	37.9895	42.5920	.011	5	2	5	0
NO MATCH	5	ATTEMPTS	6	3	.1575	.0157									
7	1	2	.00160		32.41570		-136.31477	14.030	37.9874	42.6912	.005	4	3	3	0
NO MATCH	5	ATTEMPTS	7	4	.3557	.0137									
8	1	2	.00075		32.41375		-136.31475	14.040	37.9853	42.6904	.001	4	4	1	0
8	1	2	.00132		32.41374		-136.31474	14.042	37.9867	42.5921	.006	3	5	4	0
8	1	2	.00349		32.41589		-136.31491	14.030	37.9721	42.5760	.019	5	6	7	1
NO MATCH	5	ATTEMPTS	8	7	.2455	.0126									
9	1	2	.00097		32.41330		-136.31480	14.043	37.9629	42.5658	.010	4	7	0	0
9	1	2	.00494		32.41311		-136.31491	14.047	37.9685	42.6629	.039	5	8	10	0
NO MATCH	5	ATTEMPTS	9	9	.1331	.0167									
10	1	2	.00094		32.41910		-136.31479	14.051	37.9547	42.6581	.001	3	8	1	0
10	1	2	.00237		32.41339		-136.31473	14.050	37.9667	42.6031	.097	3	9	4	0
NO MATCH	5	ATTEMPTS	10	10	.3674	.0133									
11	1	2	.00070		32.41232		-136.31452	14.073	37.9779	42.6896	.001	4	10	1	0
NO MATCH	5	ATTEMPTS	11	11	[illegible]	.0119									
12	1	2	.00015		32.41337		-136.31463	14.092	37.9747	42.5955	.010	4	11	0	0
12	1	2	.01439		32.41335		-136.31462	14.098	37.9781	42.6895	.138	5	12	13	0
NO MATCH	5	ATTEMPTS	12	13	.1534	.0205									
13	1	2	.00021		32.41300		-136.31460	14.092	37.9737	42.5962	.001	3	12	1	0
13	1	2	.03399		32.41301		-136.31459	14.097	37.9747	42.6974	.025	5	13	9	0
NO MATCH	5	ATTEMPTS	13	14	.1234	.0134									
14	1	2	.00172		32.41306		-136.31459	14.112	37.9705	42.6840	.005	3	13	3	0
14	1	2	.00205		[illegible]		-136.31455	[illegible]	37.9755	42.6909	.016	5	14	6	0
NO MATCH	5	ATTEMPTS	14	15	.3477	.0157									
15	1	2	.01152		32.41335		-136.31445	14.122	37.9845	42.7047	.004	4	15	3	0
NO MATCH	5	ATTEMPTS	15	16	.2746	.0145									
16	1	2	.00095		32.41325		-136.31452	14.123	37.9576	42.6744	.001	4	16	2	0
NO MATCH	5	ATTEMPTS	16	17	.2434	.0119									
17	1	2	.00321		32.41326		-136.31446	14.135	37.9596	42.6795	.000	4	17	0	0
17	1	2	.03459		32.41331		-136.31449	14.138	37.9560	42.6751	.035	5	18	9	0
NO MATCH	5	ATTEMPTS	17	17	[illegible]	.0199									
18	1	2	.00143		32.41343		-136.31444	14.140	37.9443	42.5554	.003	3	18	3	0
18	1	2	.00324		32.41339		-136.31441	14.147	37.9495	42.6723	.017	5	19	6	0
NO MATCH	5	ATTEMPTS	18	20	.1122	.0170									
19	1	2	.00135		32.41349		-136.31436	14.155	37.9409	42.6567	.006	4	20	3	0
NO MATCH	5	ATTEMPTS	19	21	.0579	.0138									
20	1	2	.00063		32.41252		-136.31432	14.165	37.9401	42.6692	.001	4	21	1	0
NO MATCH	5	ATTEMPTS	20	22	.3443	.0112									
21	1	2	.00035		[illegible]		-136.31425	14.178	37.9453	42.5768	.010	5	22	0	0
21	1	2	.00423		32.41342		-136.31420	14.186	37.9542	42.6980	.029	5	23	9	0
NO MATCH	5	ATTEMPTS	21	24	.1251	.0133									
22	1	2	.00190		32.41954		-136.31417	14.189	37.9422	42.5783	.006	3	23	4	0
22	1	2	.00270		32.41947		-136.31412	14.196	37.9512	42.6895	.012	5	24	5	0
NO MATCH	5	ATTEMPTS	22	25	.3673	.0157									
23	1	2	.00176		32.41947		-136.31409	14.207	37.9541	42.5943	.005	4	25	3	0
23	1	2	.00331		32.41349		-136.31409	14.207	37.9520	42.5917	.015	5	26	6	0
23	1	2	.00510		32.41945		-136.31407	14.210	37.9565	42.6977	.037	5	27	8	0
23	1	2	.01436		32.41932		-136.31402	14.217	37.9708	42.7151	.039	5	28	10	0
NO MATCH	5	ATTEMPTS	23	29	.1432	.0205									
24	1	2	.00049		32.41333		-136.31393	14.222	37.9713	42.7155	.010	3	28	1	0
24	1	2	.01415		32.41326		-136.31396	14.229	37.9779	42.7238	.020	5	29	4	0
NO MATCH	5	ATTEMPTS	24	30	.3696	.0140									
25	1	2	.00120		32.41323		-136.31396	14.235	37.9800	42.7255	.002	3	29	2	0
25	1	2	.00122		32.41330		-136.31395	14.239	37.9794	42.7247	.002	3	30	2	0
25	1	2	.00210		[illegible]		-136.31392	14.242	[illegible]	[illegible]	.008	3	31	4	0
NO MATCH	5	ATTEMPTS	25	32	.0740	.0145									
26	1	2	.00145		32.41317		-136.31393	14.258	38.0077	42.7555	.006	4	32	3	0
26	1	2	.00122		32.41305		-136.31398	14.250	38.0093	42.7573	.015	5	33	6	0
26	1	2	.00339		32.41307		-136.31394	14.265	38.0184	42.7590	.026	5	34	9	0
NO MATCH	5	ATTEMPTS	26	35	.1146	.0143									
27	1	2	.00156		[illegible]		-136.31393	14.270	38.0174	42.7581	.004	3	34	3	0
27	1	2	[illegible]		32.41533		-136.31373	14.279	38.0264	42.7733	.015	5	35	6	0
NO MATCH	5	ATTEMPTS	27	36	[illegible]	.0257									
28	1	2	[illegible]		[illegible]		[illegible]	[illegible]	38.0247	42.7736	.007	4	36	4	0

```
NO MATCH   5 ATTEMPTS  23  37   .1734   .1144
       23  1  2   .03072      32.41993   -106.31369   14.237   38.0286   42.7786   .031  4  37   1  0
NO MATCH   5 ATTEMPTS  23  39   .0472   .1115
       30  1  2   .03037      32.41977   -106.31365   14.337   38.0192   42.7795   [illegible]  5  38  [illegible]
       30  1  2   .01440      32.4131[illegible]  -106.31365   14.312   38.0179   42.7779   .032  5  39   4  0
NO MATCH   5 ATTEMPTS  31  40   .3502   .0113
       31  1  2   .01032      32.41915   -106.31364   14.321   38.0253   42.7954   [illegible]  3  40  [illegible]
       31  1  2   .00146      32.41993   -106.31363   14.323   38.0278   42.7985   [illegible]  3  41  [illegible]
       41  1  2   .03296      32.41[illegible]  -106.31360   14.326   38.0326   42.7969   .010  5  42   5  0
NO MATCH   5 ATTEMPTS  31  43   .3431   .0153
       32  1  2   .03219      32.41493   -106.31358   14.341   38.0462   42.8006   .037  4  43   4  0
NO MATCH   5 ATTEMPTS  32  44   .1727   .1163
       33  1  2   .00153      32.41930   -106.31356   14.356   38.0609   42.8237   .004  4  44   3  0
NO MATCH   5 ATTEMPTS  33  45   .3645   .0135
       34  1  2   .00030      32.41878   -106.31354   14.368   38.0663   42.8295   .002  4  45   2  0
NO MATCH   5 ATTEMPTS  34  46   .3523   .0122
       35  1  2   .03061      32.41483   -106.31356   14.391   38.0764   42.9990   .001  4  46   1  0
NO MATCH   5 ATTEMPTS  35  47   .3493   .0118
       36  1  2   .00044      32.41975   -106.31357   14.392   38.0785   42.8386   .098  4  47   0  0
NO MATCH   5 ATTEMPTS  36  48   .0427   .0109
       37  1  2   .00012      32.41967   -106.31356   14.406   38.0909   42.8511   .000  4  48   0  0
NO MATCH   5 ATTEMPTS  37  49   .3487   .0135
       38  1  2   .00011      32.41471   -106.31362   14.416   38.0927   42.8409   [illegible]  4  49   1  0
       38  1  2   .00432      32.41872   -106.31362   14.421   38.0926   42.9487   .034  5  50  18  0
NO MATCH   5 ATTEMPTS  39  51   .1537   .0212
       39  1  2   .00010      32.41466   -106.31364   14.430   38.1026   42.9567   .000  3  50   0  0
NO MATCH   5 ATTEMPTS  39  51   .0414   .0117
       40  1  2   .00025      32.41970   -106.31399   14.438   38.0981   42.8495   [illegible]  5  51  [illegible]
       40  1  2   .01453      32.41975   -106.31368   14.443   38.0991   42.9507   .333  5  52   9  0
NO MATCH   5 ATTEMPTS  40  53   .1413   .0205
       41  1  2   .03058      32.41474   -106.31369   14.449   38.1013   42.8530   .001  3  52   1  0
NO MATCH   5 ATTEMPTS  41  53   .0473   .1116
       42  1  2   .00042      32.41872   -106.31371   14.460   38.1090   42.8581   .000  4  53   0  0
       42  1  2   .03344      32.41341   -106.31375   14.461   38.1004   42.8475   .024  5  54   6  0
NO MATCH   5 ATTEMPTS  42  55   .1195   .0194
       43  1  2   .00117      32.41979   -106.31377   14.455   38.1089   42.8563   .302  3  54   5  0
       43  1  2   .00362      32.41977   -106.31376   14.474   38.1099   42.8555   .321  5  55   7  0
NO MATCH   5 ATTEMPTS  43  56   .3752   .0146
       44  1  2   .00078      32.41962   -106.31381   14.495   38.1294   42.8712   .301  3  55   1  0
       44  1  2   .00244      32.41464   -106.31391   14.488   38.1289   42.8786   .010  5  56   4  0
NO MATCH   5 ATTEMPTS  44  57   .0541   .0124
       45  1  2   .03141      32.41457   -106.31389   14.500   38.1421   42.8785   .303  3  57   3  0
       45  1  2   .03445      32.41453   -106.31390   14.503   38.1405   42.8764   .335  5  58   4  0
NO MATCH   5 ATTEMPTS  45  59   .3933   .0199
       46  1  2   .30036      32.41144   -106.31395   14.514   38.1615   42.8934   .000  3  58   1  0
       46  1  2   .00354      32.41344   -106.31395   14.518   38.1622   42.8962   .028  5  59   7  0
NO MATCH   5 ATTEMPTS  45  63   .0765   .0148
       47  1  2   .03077      32.41929   -106.31409   14.530   38.1833   42.9112   .301  3  59   1  0
       47  1  2   .00259      32.41836   -106.31403   14.531   38.1771   42.9034   .011  5  60   5  0
NO MATCH   5 ATTEMPTS  47  61   .0532   .0123
       48  1  2   .03048      32.41927   -106.31405   14.537   38.1884   42.9125   .010  3  60   1  0
       48  1  2   .03344      32.41[illegible]  -106.31399   14.541   38.1902   42.9160   .021  5  61   7  0
NO MATCH   5 ATTEMPTS  49  62   .0[illegible]   .0152
       49  1  2   .03267      32.41921   -106.31406   14.544   38.1975   42.9286   .111  5  61   5  0
NO MATCH   5 ATTEMPTS  49  62   .0603   .0131
       50  1  2   .00163      32.41915   -106.31412   14.556   38.2165   42.9376   .004  3  61   3  0
       50  1  2   .03182      32.41916   -106.31416   14.556   38.2083   42.9255   .005  3  62   3  1
       50  1  2   .00237      32.41327   -106.31421   14.553   38.1986   42.9127   .313  5  63   6  1
NO MATCH   5 ATTEMPTS  50  64   .3678   .0139
       51  1  2   .03141      32.41943   -106.31431   14.597   38.1889   42.8979   .303  5  64   3  0
NO MATCH   5 ATTEMPTS  51  65   .0670   .0139
       52  1  2   .03154      32.41945   -106.31439   14.567   38.1895   42.8939   .004  4  65   3  0
NO MATCH   5 ATTEMPTS  52  66   .0747   .0146
       53  1  2   .03217      32.41454   -106.31451   14.575   38.1957   42.8827   .000  4  66   4  0
NO MATCH   5 ATTEMPTS  53  67   .0311   .0152
       54  1  2   .00245      32.41450   -106.31456   14.588   38.1957   42.8885   .010  5  67   5  0
NO MATCH   5 ATTEMPTS  54  68   .0530   .0159
       55  1  2   .00249      32.41344   -106.31459   14.597   38.2047   42.8987   .019  5  67   5  0
       55  1  2   .00253      32.41952   -106.31462   14.599   38.1907   42.8579   .010  5  68   5  0
NO MATCH   5 ATTEMPTS  55  69   .0869   .0158
       56  1  2   .03236      32.41949   -106.31464   14.612   38.2070   42.8945   .009  5  69   5  0
NO MATCH   5 ATTEMPTS  56  70   .0643   .0140
       57  1  2   .03137      32.41346   -106.31473   14.623   38.2157   42.8908   .006  4  70   4  0
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NO MATCH	5	ATTEMPTS	57	71	.0779	.0145									
58	1	2	.00136		32.41347		-106.31475	14.636	38.2237	42.9037	.006	4	71	4	0
NO MATCH	5	ATTEMPTS	58	72	.0784	.0148									
59	1	2	.00133		32.41343		-106.31473	14.647	38.2299	42.9059	.006	4	72	4	0
NO MATCH	5	ATTEMPTS	59	73	.0751	.0147									
60	1	2	.00176		32.41342		-106.31491	14.659	38.2346	42.9098	.005	4	73	3	0
NO MATCH	5	ATTEMPTS	60	74	.0733	.0145									
61	1	2	.00170		32.41348		-106.31437	14.668	38.2333	42.9051	.005	4	74	3	0
NO MATCH	5	ATTEMPTS	61	75	.0599	.0141									
62	1	2	.00150		32.41343		-106.31483	14.680	38.2378	42.9076	.004	4	75	3	0
NO MATCH	5	ATTEMPTS	62	76	.0567	.0136									
63	1	2	.00115		32.41344		-106.31491	14.691	38.2418	42.9103	.002	4	76	2	0
NO MATCH	5	ATTEMPTS	63	77	.0630	.0134									
64	1	2	.00118		32.41357		-106.31497	14.700	38.2382	42.9027	.002	4	77	2	0
NO MATCH	5	ATTEMPTS	64	78	.0534	.0129									
65	1	2	.00074		32.41359		-106.31499	14.711	38.2406	42.9041	.001	4	78	1	0
NO MATCH	5	ATTEMPTS	65	79	.0529	.0127									
66	1	2	.00091		32.41359		-106.31503	14.722	38.2460	42.9063	.001	4	79	1	0
NO MATCH	5	ATTEMPTS	66	80	.0515	.0121									
67	1	2	.00018		32.41350		-106.31502	14.733	38.2476	42.9081	.000	4	80	0	0
NO MATCH	5	ATTEMPTS	67	81	.0429	.0110									
68	1	2	.00031		32.41368		-106.31504	14.742	38.2434	42.9026	.000	4	81	0	0
68	1	2	.00476		32.41431		-106.31509	14.743	38.2329	42.9895	.037	5	82	19	0
NO MATCH	5	ATTEMPTS	68	83	.1459	.0204									
69	1	2	.00039		32.41377		-106.31510	14.750	38.2382	42.8930	.000	3	82	0	0
69	1	2	.03436		32.41877		-106.31509	14.756	38.2404	42.9965	.031	5	83	9	0
NO MATCH	5	ATTEMPTS	69	84	.1331	.0202									
70	1	2	.00071		32.41471		-106.31517	14.753	38.2474	42.9021	.001	3	83	1	0
70	1	2	.03423		32.41379		-106.31512	14.766	38.2426	42.8961	.029	5	84	9	0
NO MATCH	5	ATTEMPTS	70	85	.1325	.0195									
71	1	2	.00034		32.41376		-106.31514	14.774	38.2495	42.9017	.001	3	84	1	0
71	1	2	.03410		32.41378		-106.31514	14.779	38.2482	42.9001	.026	5	85	8	0
NO MATCH	5	ATTEMPTS	71	86	.1287	.0192									
72	1	2	.00124		32.41377		-106.31515	14.785	38.2520	42.9032	.002	3	85	2	0
72	1	2	.03369		32.41324		-106.31517	14.798	38.2472	42.8972	.022	5	86	7	0
NO MATCH	5	ATTEMPTS	72	87	.1173	.0183									
73	1	2	.00154		32.41334		-106.31513	14.794	38.2495	42.8990	.004	3	86	3	0
73	1	2	.03320		32.41347		-106.31513	14.798	38.2482	42.8974	.017	5	87	6	0
NO MATCH	5	ATTEMPTS	73	88	.1232	.0176									
74	1	2	.00146		32.41437		-106.31513	14.806	38.2551	42.9030	.006	3	87	4	0
74	1	2	.03313		32.41491		-106.31523	14.808	38.2489	42.8942	.016	5	88	6	0
NO MATCH	5	ATTEMPTS	74	89	.1213	.0171									
75	1	2	.00223		32.41491		-106.31523	14.814	38.2502	42.8960	.008	3	88	4	0
75	1	2	.03258		32.41432		-106.31522	14.819	38.2513	42.8972	.011	5	89	5	0
NO MATCH	5	ATTEMPTS	75	90	.1338	.0150									
76	1	2	.00132		32.41338		-106.31522	14.829	38.2490	42.8949	.006	4	90	4	0
NO MATCH	5	ATTEMPTS	76	91	.0732	.0150									
77	1	2	.00173		32.41317		-106.31527	14.837	38.2434	42.8862	.005	4	91	3	0
NO MATCH	5	ATTEMPTS	77	92	.0733	.0145									
78	1	2	.00142		32.41017		-106.31531	14.845	38.2374	42.8778	.003	4	92	3	0
NO MATCH	5	ATTEMPTS	78	93	.0632	.0134									
79	1	2	.00056		32.41025		-106.31530	14.853	38.2321	42.8729	.001	4	93	1	0
NO MATCH	5	ATTEMPTS	79	94	.2436	.0113									
80	1	2	.00077		32.41339		-106.31533	14.860	38.2212	42.8526	.000	4	94	0	0
80	1	2	.03456		32.41945		-106.31532	14.863	38.2165	42.8567	.033	5	95	9	0
NO MATCH	5	ATTEMPTS	80	96	.1433	.0202									
81	1	2	.00345		32.41346		-106.31532	14.869	38.2171	42.8572	.001	3	95	1	0
81	1	2	.03472		32.41359		-106.31533	14.873	38.2147	42.8542	.026	5	96	9	0
NO MATCH	5	ATTEMPTS	81	97	.1246	.0139									
82	1	2	.00147		32.41953		-106.31532	14.878	38.2138	42.8534	.005	3	96	3	0
82	1	2	.03370		32.41956		-106.31531	14.883	38.2148	42.8547	.017	5	97	7	0
NO MATCH	5	ATTEMPTS	82	98	.1152	.0173									
83	1	2	.00279		32.41359		-106.31533	14.887	38.2107	42.8515	.009	5	97	5	0
83	1	2	.03240		32.41959		-106.31529	14.892	38.2119	42.8527	.009	5	98	5	0
NO MATCH	5	ATTEMPTS	83	99	.0888	.0155									
84	1	2	.00152		32.41965		-106.31529	14.902	38.2092	42.8506	.004	4	99	3	0
NO MATCH	5	ATTEMPTS	84	100	.0632	.0141									
85	1	2	.00129		32.41978		-106.31533	14.910	38.2035	42.8439	.002	4	100	2	0
NO MATCH	5	ATTEMPTS	85	101	.0532	.0123									
86	1	2	.00073		32.41373		-106.31527	14.922	38.2087	42.8501	.000	4	101	0	0
NO MATCH	5	ATTEMPTS	86	102	.0422	.0117									
87	1	2	.00024		32.41343		-106.31525	14.936	38.2101	42.8601	.000	4	102	0	0
87	1	2	.03447		32.41341		-106.31533	14.945	38.2064	42.8456	.038	5	103	18	0

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NO MATCH   5 ATTEMPTS  87 114   .1432   .3216
      88   1  2  .03342   32.41335   -106.31523   14.940   38.2024   42.9424   .005  3  103   1  0
      88   1  2  .03336   32.41335   -106.31524   14.946   38.2046   42.9451   .025  5  104   8  0
NO MATCH   5 ATTEMPTS  88 105   [illegible]   [illegible]
      89   1  2  .03170   32.41336   -106.31528   14.953   38.2084   42.9482   .003  3  104   2  0
      89   1  2  .03362   32.41346   -106.31523   14.957   38.2083   42.9440   .020  5  105   7  0
NO MATCH   5 ATTEMPTS  89 106   .1159   .3142
      90   1  2  .03145   32.41331   -106.31530   14.965   38.2168   42.8549   .003  3  105   3  0
      90   1  2  .03351   32.41340   -106.31533   14.968   38.2109   42.8475   .020  5  106   7  0
NO MATCH   5 ATTEMPTS  90 107   .1125   .3179
      91   1  2  .03177   32.41342   -106.31535   14.977   38.2211   42.8557   .003  3  106   2  0
      91   1  2  .03340   32.41345   -106.31535   14.991   38.2199   42.8561   .019  5  107   7  0
NO MATCH   5 ATTEMPTS  91 109   .1115   .3179
      92   1  2  .03185   32.41335   -106.31536   14.987   38.2220   42.8559   .006  3  107   3  0
      92   1  2  .03333   32.41333   -106.31536   14.991   38.2208   42.8543   .014  5  108   6  0
NO MATCH   5 ATTEMPTS  92 109   .1166   .3175
      93   1  2  .03245   32.42344   -106.31541   14.996   38.2039   42.8351   .010  5  109   9  0
NO MATCH   5 ATTEMPTS  93 110   .1036   .3163
      94   1  2  .03203   32.42327   -106.31547   15.000   38.1875   42.8157   .007  4  110   4  0
NO MATCH   5 ATTEMPTS  94 111   .1749   .3145
      95   1  2  .00222   32.42311   -106.31552   15.012   38.2086   42.8327   .008  3  110   4  0
      95   1  2  .03257   32.42312   -106.31552   15.017   38.2096   42.8340   .011  5  111   5  0
NO MATCH   5 ATTEMPTS  95 112   .0375   .3155
      96   1  2  .03197   32.42301   -106.31555   15.022   38.2232   42.8445   .006  3  111   4  0
NO MATCH   5 ATTEMPTS  96 112   .0734   .3142
      97   1  2  .03229   32.41335   -106.31560   15.034   38.2443   42.8618   .008  5  111   4  0
      97   1  2  .03236   32.41331   -106.31557   15.042   38.2511   42.8703   .009  5  112   5  0
NO MATCH   5 ATTEMPTS  97 113   [illegible]   .3150
      98   1  2  .03225   32.41373   -106.31561   15.052   38.2560   42.8423   .008  5  112   4  0
      98   1  2  .03244   32.41382   -106.31565   15.053   38.2555   42.8692   .013  5  113   6  0
NO MATCH   5 ATTEMPTS  98 114   .0973   .3167
      99   1  2  .03155   32.41375   -106.31568   15.062   38.2672   42.8786   .006  3  113   4  0
      99   1  2  .03239   32.41331   -106.31570   15.065   38.2624   42.8727   .014  5  114   6  0
NO MATCH   5 ATTEMPTS  99 115   .1157   .0174
     100   1  2  .03205   32.41377   -106.31572   15.072   38.2694   42.8793   .007  3  114   4  0
     100   1  2  .03349   32.41380   -106.31575   15.074   38.2577   42.8638   .015  5  115   6  0
NO MATCH   5 ATTEMPTS 100 116   .0349   .3163
     101   1  2  .03227   32.41335   -106.31578   15.079   38.2600   42.8656   .008  5  115   4  0
     101   1  2  .03251   32.41391   -106.31577   15.084   38.2511   42.8669   .010  5  116   5  0
NO MATCH   5 ATTEMPTS 101 117   .0315   .3152
     102   1  2  .03240   32.41338   -106.31582   15.093   38.2583   42.8610   .009  5  117   5  0
NO MATCH   5 ATTEMPTS 102 118   .0930   .3159
     103   1  2  .03137   32.41376   -106.31587   15.104   38.2779   42.8760   .006  3  117   4  0
     103   1  2  [illegible]   32.41375   -106.31590   15.106   38.2705   42.8680   .015  5  118   6  0
NO MATCH   5 ATTEMPTS 103 119   .1315   .3171
     104   1  2  .03181   32.41935   -106.31593   15.115   38.2810   42.8761   .005  3  118   3  0
     104   1  2  .00317   32.41939   -106.31594   15.119   38.2785   42.8731   .015  5  119   6  0
NO MATCH   5 ATTEMPTS 104 120   .1395   .3176
     105   1  2  .00237   32.41938   -106.31595   15.126   38.2940   42.8775   .007  3  119   4  0
     105   1  2  .00307   32.42032   -106.31601   15.126   38.2711   42.8615   .015  5  120   6  1
NO MATCH   5 ATTEMPTS 105 121   .1372   .3175
     106   1  2  .03278   32.41379   -106.31602   15.133   38.2765   42.8659   .007  3  120   4  0
     106   1  2  .00332   32.42311   -106.31607   15.134   38.2660   42.8528   .015  5  121   6  0
NO MATCH   5 ATTEMPTS 106 122   .0932   .3153
     107   1  2  .03175   32.42035   -106.31609   15.142   38.2762   42.8609   .005  3  121   3  0
     107   1  2  .00234   32.42036   -106.31609   15.148   38.2772   42.8622   .014  5  122   6  0
NO MATCH   5 ATTEMPTS 107 123   .1359   .3157
     108   1  2  .03238   32.42006   -106.31609   15.154   38.2795   42.8641   .009  5  122   5  0
     108   1  2  .00244   32.42018   -106.31609   15.159   38.2794   42.8639   .010  5  123   5  0
NO MATCH   5 ATTEMPTS 108 124   .0942   .3154
     109   1  2  .03251   32.42022   -106.31617   15.165   38.2697   42.8494   .019  5  124   5  0
NO MATCH   5 ATTEMPTS 109 125   .1514   .3161
     110   1  2  .03237   32.42029   -106.31622   15.174   38.2681   42.8450   .009  5  125   5  0
NO MATCH   5 ATTEMPTS 110 126   .0346   .3136
     111   1  2  .00024   32.42027   -106.31622   15.177   38.2708   42.8466   .000  3  125   0  0
     111   1  2  .00453   32.42031   -106.31623   15.181   38.2676   42.8435   .035  5  126   9  0
NO MATCH   5 ATTEMPTS 111 127   .1513   .3209
     112   1  2  .03040   32.42020   -106.31624   15.178   38.2730   42.8479   .000  3  126   1  0
     112   1  2  .03456   32.42039   -106.31629   15.190   38.2636   42.8363   .033  5  127   9  0
NO MATCH   5 ATTEMPTS 112 128   .1437   .3231
     113   1  2  .03075   32.42041   -106.31623   15.196   38.2660   42.8381   .001  3  127   1  0
     113   1  2  .00403   32.42040   -106.31629   15.201   38.2670   42.8394   .026  5  128   8  0
NO MATCH   5 ATTEMPTS 113 129   .1270   .3191
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	114	1	2	.00111	32.42076		-106.31673	15.219	38.2740	42.8451	.002	3	129	2	0
	116	1	2	.00333	32.42180		-106.31630	15.213	38.2727	42.8435	.024	5	129	9	0
NO MATCH		5	ATTEMPTS	114 130	.1271	.0133									
	115	1	2	.00179	32.42773		-106.31671	15.213	38.2766	42.8455	.003	3	129	2	0
	115	1	2	.00352	32.42143		-106.31632	15.223	38.2730	42.8421	.020	5	130	7	0
NO MATCH		5	ATTEMPTS	115 131	.1144	.0141									
	115	1	2	.00227	32.42047		-106.31531	15.228	38.2707	42.8432	.007	3	130	4	0
	115	1	2	.00234	32.42052		-106.31633	15.231	38.2671	42.8358	.013	5	131	6	0
NO MATCH		5	ATTEMPTS	116 132	.0952	.0155									
	117	1	2	.00228	32.42057		-106.31633	15.241	38.2665	42.8348	.008	5	132	4	0
NO MATCH		5	ATTEMPTS	117 133	.0333	.0154									
	118	1	2	.00233	32.42055		-106.31637	15.253	38.2731	42.8385	.009	5	133	5	0
NO MATCH		5	ATTEMPTS	118 134	.0739	.0153									
	119	1	2	.00175	32.42057		-106.31635	15.262	38.2827	42.8487	.005	4	134	3	0
NO MATCH		5	ATTEMPTS	119 135	.0727	.0144									
	120	1	2	.00114	32.42052		-106.31636	15.274	38.2740	42.8396	.002	4	135	2	0
NO MATCH		5	ATTEMPTS	120 136	.0573	.0124									
	121	1	2	.00064	32.42057		-106.31637	15.283	38.2729	42.8370	.001	4	136	1	0
NO MATCH		5	ATTEMPTS	121 137	.0453	.0115									
	122	1	2	.00013	32.42054		-106.31635	15.295	38.2753	42.8405	.000	4	137	9	0
	122	1	2	.00195	32.42072		-106.31636	15.296	38.2723	42.8365	.006	3	138	4	0
NO MATCH		5	ATTEMPTS	122 139	.0732	.0145									
	123	1	2	.00115	32.42077		-106.31635	15.335	38.2709	42.8362	.002	4	139	2	0
NO MATCH		5	ATTEMPTS	123 140	.0547	.0125									
	124	1	2	.00042	32.42074		-106.31632	15.318	38.2774	42.8439	.000	4	140	0	0
NO MATCH		5	ATTEMPTS	124 141	.0427	.0111									
	125	1	2	.00015	32.42073		-106.31630	15.330	38.2831	42.8499	.000	4	141	0	0
	125	1	2	.00454	32.42031		-106.31544	15.332	38.2760	42.8411	.030	5	142	17	0
NO MATCH		5	ATTEMPTS	125 143	.1446	.0204									
	125	1	2	.00047	32.42031		-106.31634	15.339	38.2784	42.8430	.000	3	142	1	0
	126	1	2	.00415	32.42076		-106.31630	15.346	38.2852	42.8515	.028	5	143	9	0
NO MATCH		5	ATTEMPTS	126 144	.1325	.0135									
	127	1	2	.00115	32.42076		-106.31633	15.352	38.2976	42.8534	.002	3	143	2	0
	127	1	2	.00376	32.42032		-106.31632	15.356	38.2840	42.8490	.025	5	144	8	0
NO MATCH		5	ATTEMPTS	127 145	.1135	.0139									
	128	1	2	.00173	32.42094		-106.31531	15.361	38.2832	42.8483	.005	3	144	7	0
	128	1	2	.00290	32.42079		-106.31623	15.368	38.2900	42.8569	.014	5	145	6	0
NO MATCH		5	ATTEMPTS	128 146	.0958	.0157									
	129	1	2	.00241	32.42079		-106.31629	15.374	38.2924	42.8587	.009	5	145	5	0
	129	1	2	.00244	32.42082		-106.31628	15.379	38.2911	42.8572	.010	5	146	5	0
NO MATCH		5	ATTEMPTS	129 147	.0953	.0157									
	130	1	2	.00152	32.42093		-106.31529	15.399	38.2895	42.8548	.006	4	147	4	0
NO MATCH		5	ATTEMPTS	130 148	.0731	.0165									
	131	1	2	.00115	32.42093		-106.31625	15.398	38.2970	42.8527	.002	4	148	2	0
NO MATCH		5	ATTEMPTS	131 149	.0569	.0124									
	132	1	2	.00053	32.42034		-106.31628	15.409	38.2904	42.8560	.001	4	149	1	0
NO MATCH		5	ATTEMPTS	132 150	.0468	.0116									
	133	1	2	.00031	32.42035		-106.31626	15.420	38.2934	42.8593	.000	4	150	0	0
	133	1	2	.03474	32.42096		-106.31625	15.426	38.2957	42.8621	.036	5	151	10	0
NO MATCH		5	ATTEMPTS	133 152	.1473	.0296									
	134	1	2	.00047	32.42033		-106.31526	15.433	38.2996	42.8653	.000	3	151	1	0
	134	1	2	.00494	32.42094		-106.31625	15.437	38.2995	42.8651	.030	5	152	9	0
NO MATCH		5	ATTEMPTS	134 153	.1362	.0197									
	135	1	2	.00097	32.42095		-106.31626	15.443	38.3019	42.8670	.002	3	152	2	0
	135	1	2	.00305	32.42037		-106.31626	15.448	38.3018	42.8669	.024	5	153	8	0
NO MATCH		5	ATTEMPTS	135 154	.1211	.0196									
	136	1	2	.00136	32.42036		-106.31624	15.455	38.3057	42.8701	.003	3	153	2	0
	136	1	2	.00345	32.42098		-106.31626	15.460	38.3056	42.8700	.019	5	154	7	0
NO MATCH		5	ATTEMPTS	136 155	.1194	.0177									
	137	1	2	.00274	32.42170		-106.31625	15.465	38.3068	42.8693	.007	3	154	4	0
	137	1	2	.00275	32.42171		-106.31625	15.470	38.3059	42.8707	.012	5	155	5	0
NO MATCH		5	ATTEMPTS	137 156	.1945	.0155									
	138	1	2	.00244	32.42135		-106.31627	15.480	38.3063	42.8694	.010	5	156	5	0
NO MATCH		5	ATTEMPTS	138 157	.1556	.0157									
	139	1	2	.00198	32.42140		-106.31629	15.491	38.3074	42.8697	.006	4	157	4	0
NO MATCH		5	ATTEMPTS	139 158	.1759	.0148									
	140	1	2	.00146	32.42113		-106.31629	15.530	38.3058	42.8674	.013	4	158	3	0
NO MATCH		5	ATTEMPTS	140 159	.0954	.0137									
	141	1	2	.00038	32.42121		-106.31630	15.509	38.3015	42.8623	.001	4	159	1	0
NO MATCH		5	ATTEMPTS	141 160	.0523	.0122									
	142	1	2	.00021	32.42126		-106.31629	15.519	38.3006	42.8616	.000	4	160	0	0
NO MATCH		5	ATTEMPTS	142 161	.0402	.0107									
	143	1	2	.00031	32.42126		-106.31629	15.538	38.3041	42.8640	.000	4	161	0	0

Part II. Sample Output of Velocity Program.

The columns of the velocity program are labeled, with the exception of columns 7 and 9, that list the errors in the velocity components in meters per second to within the nearest decimeter per second.

The difference between columns 2 and 1 represents the time elapsed (in seconds) between the first and last trail position files used to compute the velocity.

Column 3 is the altitude in kilometers.

Columns 4 and 5 give the azimuth and magnitude of the velocity vector. For example, an azimuth of 90 degrees and magnitude of 20 meters would correspond to a wind of 20 m/sec blowing from West to East.

Columns 6 and 7 list the East-West component of the wind and its standard error.

Columns 8 and 9 give the North-South component of the wind and its standard error.

The last column indicates the number of frames that were used to compute the wind, that is, through how many points a least-squares straight line was fitted, whose slope is the wind at that altitude.

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEN M/S		VNS M/S		NP
40.	95.	16.9600	127.35	19.2	15.2	.2	-11.6	.3	4
40.	95.	16.9800	128.04	18.4	14.5	.3	-11.4	.4	4
40.	.5.	17.0000	115.63	15.4	13.9	.1	-6.7	.2	4
40.	95.	17.0200	117.38	15.7	13.9	.0	-7.2	.1	4
40.	95.	17.0400	119.32	16.4	14.3	.1	-6.0	.1	4
40.	95.	17.0600	[illegible]	16.3	14.2	.0	-8.1	.1	4
40.	95.	17.0800	[illegible]	16.5	14.3	.0	-[illegible].2	.1	4
40.	95.	17.1000	120.45	16.5	14.2	.0	-8.3	.1	4
40.	95.	17.1200	122.18	16.6	14.0	.0	-8.8	.1	4
40.	95.	17.1400	121.36	16.2	13.[illegible]	[illegible]	-6.4	.2	4
40.	95.	17.1600	120.23	15.8	13.7	.0	-[illegible].0	.1	4
40.	.5.	17.1800	122.3[illegible]	16.0	13.5	.0	-8.6	.1	4
40.	95.	17.2000	115.23	15.1	13.7	.0	-6.4	.2	4
40.	95.	17.2200	112.48	15.3	14.2	.0	-5.9	.1	4
40.	95.	17.2400	[illegible]	15.5	14.6	.0	-5.8	.2	4
40.	.5.	17.2600	110.25	15.6	14.7	.0	-5.4	.1	4
40.	95.	17.2800	112.94	15.7	14.5	.1	-6.1	.0	4
40.	95.	17.3000	114.27	15.7	14.3	.0	-6.6	.1	4
40.	95.	17.3200	117.15	15.9	14.1	.0	-7.2	.1	4
40.	95.	17.3400	119.05	16.0	14.0	.0	-7.0	.1	4
40.	.5.	17.3600	117.58	15.9	14.1	.0	-7.3	.3	4
40.	95.	17.3800	115.52	15.6	14.1	.0	-6.7	.0	4
40.	95.	17.4000	116.92	15.8	14.1	.0	-7.2	.1	4
40.	95.	17.4200	116.37	15.9	13.9	.1	-7.7	.1	4
40.	.5.	17.4400	128.25	16.1	13.[illegible]	.1	-[illegible].1	.0	4
40.	95.	17.4600	121.98	16.1	13.7	.0	-8.5	.1	4
40.	95.	17.4800	122.96	16.4	13.8	.0	-8.9	.0	4
40.	95.	17.5000	125.42	16.7	13.6	[illegible]	-9.7	.1	4
40.	95.	17.5200	128.18	17.5	13.6	.1	-10.7	.4	4
40.	.5.	17.5400	129.57	17.6	13.6	.1	-11.2	1.0	4
40.	95.	17.5600	123.11	15.4	12.9	.0	-8.4	.3	4
40.	95.	17.5800	123.25	15.1	12.6	[illegible]	-6.3	.1	4
40.	95.	17.6000	123.54	15.3	12.7	.1	-8.5	.0	4
40.	.5.	17.6200	125.10	15.5	12.7	.1	[illegible]	.2	4
40.	95.	17.6400	128.67	16.2	12.6	.2	-10.1	.3	4
40.	95.	17.6600	130.37	16.5	12.4	.4	-10.8	.2	4
40.	95.	17.6800	133.75	16.9	12.2	.6	-11.7	.6	4
40.	95.	17.7000	135.78	17.7	12.3	[illegible]	-12.7	1.3	4
40.	.5.	17.7200	137.49	17.9	12.1	.9	-13.2	1.7	4
40.	95.	17.7400	127.34	10.6	8.4	.0	-6.5	.1	4
40.	95.	17.7600	129.12	10.5	8.1	.0	-6.6	.1	4
40.	95.	17.7800	130.59	10.7	8.2	.1	-7.0	.1	4
40.	5.	17.[illegible]000	131.[illegible]3	10.6	7.[illegible]	.1	-7.1	.3	4
40.	95.	17.8200	129.41	9.8	7.5	.0	-6.3	.2	4
40.	95.	17.8400	129.32	9.6	7.4	.0	-6.2	.1	4
40.	95.	17.8600	124.6[illegible]	9.1	7.4	.0	-5.2	.2	4
40.	95.	17.8800	125.71	9.2	7.5	.0	-5.4	.1	4
40.	.5.	17.9000	127.[illegible]8	9.0	7.6	.0	-5.8	.0	4
40.	95.	17.9200	128.[illegible]	9.8	7.6	.0	-6.1	.1	4
40.	95.	17.9400	130.48	10.1	7.7	[illegible]	-6.6	.1	4
40.	95.	17.9600	129.51	9.9	7.7	.1	-6.3	.5	4
40.	.5.	17.9800	112.51	[illegible]	[illegible].2	.1	-3.4	.2	4
40.	95.	18.0000	114.55	9.3	8.5	.0	-3.9	.1	4
40.	95.	18.0200	118.00	9.6	8.5	.0	-4.6	.1	4
40.	95.	18.0400	[illegible].67	9.6	[illegible].3	.1	-4.[illegible]	.0	4
40.	95.	18.0600	122.43	9.7	8.2	.1	-5.2	.1	4
40.	.5.	18.0800	124.57	10.1	8.3	.0	-5.7	.1	4
40.	95.	18.1000	127.77	10.3	8.1	[illegible]	-6.3	.1	4
40.	95.	18.1200	13[illegible].[illegible]7	10.7	[illegible].2	.1	-6.9	.1	4
40.	95.	18.1400	133.[illegible]	11.3	8.2	[illegible]	-7.8	.5	4
40.	.5.	18.1600	136.2[illegible]	11.3	7.[illegible]	.3	-[illegible].1	.6	4
40.	95.	18.1800	131.85	8.7	6.5	.0	-5.8	.1	4
40.	95.	18.2000	134.50	8.8	6.3	.1	-6.2	.1	4
40.	95.	18.2200	137.11	9.0	6.2	.1	-6.6	.0	4
40.	95.	18.2400	139.28	9.2	6.0	.1	-6.[illegible]	.1	4
40.	.5.	18.2600	141.44	9.6	5.9	.3	-7.5	.3	4
40.	95.	18.2800	144.47	10.0	5.8	.4	-8.1	.5	4
40.	95.	18.3000	145.73	9.6	5.4	.4	[illegible]	.4	4
40.	95.	18.3200	147.74	7.6	4.1	.1	-6.4	.2	4
40.	.5.	18.3400	151.[illegible]	[illegible].3	3.[illegible]	.1	-7.3	.3	4
40.	95.	18.3600	155.14	9.2	3.9	.3	-8.4	.3	4
40.	95.	18.3800	157.31	9.6	3.7	.6	-8.9	.2	4
40.	95.	18.4000	159.15	10.1	3.6	.6	-9.4	.0	4

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEW M/S		VNS M/S		NP
40.	5.	15.5000	125.22	16.[illegible]	13.7	.0	-9.7	.1	4
40.	95.	15.5200	123.46	16.2	13.5	.0	-9.0	.1	4
40.	95.	15.5400	124.73	16.2	13.3	.0	-9.2	.2	4
40.	95.	15.5600	122.24	15.5	13.1	.0	-8.3	.2	4
40.	95.	15.5800	117.72	14.[illegible]	13.2	.0	-6.[illegible]	.1	4
40.	95.	15.6000	116.52	14.8	13.2	.0	-6.6	.1	4
40.	95.	15.6200	113.72	14.6	13.4	.0	-5.9	.0	4
40.	95.	15.6400	110.67	14.4	13.5	.0	-5.1	.1	4
40.	95.	15.6600	103.48	14.4	14.0	.0	-3.3	.1	4
40.	.5.	15.6800	105.60	14.7	14.2	.1	-4.0	.1	4
40.	95.	15.7000	105.68	15.0	14.4	.0	-4.0	.0	4
40.	95.	15.7200	106.33	15.4	14.8	.0	-4.3	.1	4
40.	95.	15.7400	107.75	15.6	15.1	.0	-4.8	.1	4
40.	95.	15.7600	107.[illegible]1	16.1	15.3	.0	-4.[illegible]	.1	4
40.	95.	15.7800	107.13	16.5	15.8	.0	-4.9	.1	4
40.	95.	15.8000	106.36	16.8	16.1	.0	-4.7	.1	4
40.	95.	15.8200	106.[illegible]	17.2	16.4	.[illegible]	-5.0	.1	4
40.	95.	15.8400	105.09	17.6	16.9	.0	-4.8	.1	4
40.	.5.	15.8600	106.30	17.[illegible]	17.1	.0	-5.0	.1	4
40.	95.	15.8800	107.53	18.2	17.4	.0	-5.5	.1	4
40.	95.	15.9000	108.75	18.6	17.6	.0	-6.0	.1	4
40.	95.	15.9200	109.72	1[illegible]	17.[illegible]	.0	-6.4	.1	4
40.	95.	15.9400	110.35	1[illegible].1	17.[illegible]	.1	-6.5	.1	4
40.	95.	15.9600	111.00	19.3	18.0	.1	-7.1	.0	4
40.	95.	15.9800	112.70	19.7	18.2	.0	-7.6	.1	4
40.	95.	16.0000	11[illegible]	20.0	18.2	.1	-8.2	.1	4
40.	95.	16.0200	115.29	20.2	18.2	.1	-8.6	.1	4
40.	.5.	16.0400	116.51	20.3	18.2	.1	-9.1	.1	4
40.	95.	16.0600	117.92	20.5	18.1	.1	-9.6	.1	4
40.	95.	16.0800	119.32	20.7	17.9	.1	-10.3	.0	4
40.	95.	16.1000	121.42	20.[illegible]	17.[illegible]	.2	-10.9	.0	4
40.	95.	16.1200	122.40	21.2	17.[illegible]	.1	-11.3	.1	4
40.	95.	16.1400	123.60	21.3	17.8	.1	-11.8	.0	4
40.	95.	16.1600	124.50	21.7	17.9	.1	-12.3	.0	4
40.	95.	16.1800	125.29	22.2	18.1	.1	-12.6	.2	4
40.	95.	16.2000	126.85	22.8	18.3	.1	-13.7	.3	4
40.	.5.	16.2200	12[illegible].53	23.7	18.5	.1	-14.7	.4	4
40.	95.	16.2400	130.06	24.4	18.5	.5	-15.9	.3	4
40.	95.	16.2600	131.76	24.8	19.5	1.[illegible]	-16.6	.9	4
40.	95.	16.2800	133.[illegible]0	25.6	18.7	1.1	-17.5	1.0	4
40.	95.	16.3000	134.30	20.4	14.6	.1	-14.2	.3	4
40.	95.	16.3200	134.96	19.2	13.6	.3	-13.6	.3	4
40.	95.	16.3400	136.10	18.8	13.0	.3	-13.5	.4	4
40.	95.	16.3600	136.11	17.5	12.1	.2	-12.6	.3	4
40.	95.	16.3800	136.34	16.5	11.4	.2	-11.9	.4	4
40.	.5.	16.4000	135.61	15.4	10.8	.1	-11.0	.4	4
40.	95.	16.4200	134.95	14.4	10.2	.1	-10.2	.2	4
40.	95.	16.4400	132.57	13.4	9.9	.0	-[illegible].1	.2	4
40.	95.	16.4600	127.12	12.1	9.6	.0	-7.3	.1	4
40.	5.	16.4800	11[illegible].[illegible]1	11.5	10.1	.0	-5.6	.2	4
40.	95.	16.5000	111.06	11.9	11.1	.0	-4.3	.2	4
40.	95.	16.5200	112.01	12.6	11.6	.1	-4.7	.1	4
40.	95.	16.5400	1[illegible]7.66	13.[illegible]	12.5	.2	-4.0	.2	4
40.	95.	16.5600	108.[illegible]9	13.6	12.[illegible]	.1	-4.4	.1	4
40.	.5.	16.5800	109.73	14.2	13.3	.1	-4.8	.0	4
40.	95.	16.6000	109.[illegible]8	14.6	13.8	.1	-4.8	.1	4
40.	95.	16.6200	104.95	15.6	15.1	.1	-3.9	.2	4
40.	95.	16.6400	105.33	15.8	15.3	.1	-4.2	.1	4
40.	.5.	16.6600	106.51	16.1	15.4	.0	-4.6	.1	4
40.	95.	16.6800	108.44	16.3	15.5	.1	-5.2	.1	4
40.	95.	16.7000	109.71	16.6	15.6	.0	-5.6	.0	4
40.	95.	16.7200	111.15	16.6	15.5	.1	-6.0	.1	4
40.	95.	16.7400	113.30	16.8	15.4	.2	-6.7	.1	4
40.	5.	16.7600	114.34	17.1	15.5	.2	-7.0	.1	4
40.	95.	16.7800	115.74	17.4	15.6	.2	-7.5	.0	4
40.	95.	16.8000	117.[illegible]	17.6	15.[illegible]	.2	-[illegible]	.1	4
40.	95.	16.8200	118.36	18.1	15.9	.2	-8.6	.1	4
40.	.5.	16.8400	11[illegible].[illegible]2	1[illegible].3	15.[illegible]	.2	-[illegible].1	.1	4
40.	95.	16.8600	121.39	19.1	16.3	.1	-9.8	.1	4
40.	95.	16.8800	122.95	20.0	16.9	.1	-10.8	.1	4
40.	95.	16.9000	124.43	20.2	16.7	.1	-11.4	.2	4
40.	95.	16.9200	126.25	20.4	16.4	.2	-12.0	.1	4
40.	95.	16.9400	126.42	19.1	15.4	.1	-11.4	.1	4

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEW M/S		VNS M/S		NR
40.	70.	14.0400	115.01	27.9	25.3	[illegible]	-11.6	.5	3
40.	70.	14.0600	116.06	28.9	25.9	.0	-12.7	.2	3
40.	70.	14.0800	[illegible]	29.4	26.5	.0	[illegible]	.1	3
40.	95.	14.1000	110.14	29.2	26.3	.1	-12.9	.1	4
40.	95.	14.1200	116.19	29.3	26.3	.0	-12.9	.2	4
40.	95.	14.1400	114.76	29.2	26.5	.1	-12.2	.1	4
40.	95.	14.1600	112.56	29.3	27.1	.1	-11.2	.2	4
40.	95.	14.1800	108.50	29.8	28.3	.0	-9.5	.3	4
40.	95.	14.2000	109.37	30.0	28.3	.1	-9.9	.0	4
40.	95.	14.2200	110.40	30.5	28.5	.0	-10.6	.1	4
40.	95.	14.2400	111.58	31.1	28.9	.1	-11.4	.1	4
40.	95.	14.2600	[illegible]	[illegible]	29.4	.1	-12.2	.1	4
40.	95.	14.2800	113.46	32.3	29.6	.1	-12.8	.2	4
40.	95.	14.3000	113.42	32.9	30.2	.0	-13.1	.2	4
40.	95.	14.3200	113.66	33.6	[illegible]	.0	-13.5	.1	4
40.	95.	14.3400	113.88	33.6	30.8	.1	-13.6	.0	4
40.	95.	14.3600	114.28	33.9	30.9	.1	-13.9	.1	4
40.	95.	14.3800	114.30	33.9	30.8	.1	[illegible]	.1	4
40.	95.	14.4000	115.31	34.6	31.2	.1	-15.1	.1	4
40.	95.	14.4200	116.10	34.8	31.3	.1	-15.3	.1	4
40.	95.	14.4400	116.74	35.0	31.3	.0	-15.7	.1	4
40.	95.	14.4600	117.29	35.1	31.2	.1	-16.1	.1	4
40.	95.	14.4800	[illegible]	34.9	30.9	.0	-16.3	.1	4
40.	95.	[illegible]	117.65	[illegible]	[illegible]	.1	-16.1	.1	4
40.	95.	14.5200	117.65	34.3	30.3	.0	[illegible]	.2	4
40.	95.	14.5400	118.43	34.3	30.2	.1	-16.3	.0	4
40.	95.	14.5600	119.00	34.6	30.3	.1	-16.8	.1	4
40.	95.	14.5800	120.42	35.4	30.5	.1	-17.9	.5	4
40.	95.	14.6000	121.71	35.8	30.5	.0	-18.8	.6	4
40.	95.	14.6200	[illegible]	36.0	30.3	.6	[illegible]	.7	4
40.	95.	14.6400	124.16	36.0	29.8	.5	-20.2	.3	4
40.	95.	14.6600	125.30	36.1	29.5	1.0	-20.9	.5	4
40.	95.	[illegible]	126.63	36.7	29.5	1.0	-21.9	.5	4
40.	95.	14.7000	127.82	37.3	29.4	1.1	[illegible]	.7	4
40.	95.	14.7200	128.28	37.4	29.4	1.3	-23.2	1.0	4
40.	95.	14.7400	129.64	37.8	29.2	1.4	-24.2	1.2	4
40.	95.	14.7600	130.33	38.5	29.1	1.4	-25.2	1.4	4
40.	95.	14.7800	130.32	30.1	23.0	.1	-19.5	.2	4
40.	95.	14.8000	130.47	[illegible]	22.7	.1	[illegible]	.2	4
40.	95.	14.8200	130.46	29.2	22.2	.0	-18.9	.1	4
40.	95.	14.8400	130.67	28.9	21.9	.0	-18.9	.2	4
40.	95.	[illegible]	[illegible]	28.9	21.7	.1	[illegible]	.2	4
40.	95.	14.8800	[illegible]	27.7	21.2	.1	[illegible]	.6	4
40.	95.	14.9000	128.80	26.9	20.9	.0	-16.8	.6	4
40.	95.	14.9200	124.17	25.3	21.0	.0	-14.2	.1	4
40.	95.	14.9400	123.59	25.5	21.2	[illegible]	-14.2	.1	4
40.	95.	14.9600	123.81	25.5	21.2	.0	-14.2	.1	4
40.	95.	[illegible]	123.32	25.3	21.2	.0	[illegible]	.2	4
40.	95.	15.0000	123.16	25.2	21.1	.1	-13.8	.2	4
40.	95.	15.0200	123.37	25.0	20.9	.1	-13.8	.3	4
40.	95.	15.0400	122.71	24.6	[illegible]	.1	-13.3	.4	4
40.	95.	15.0600	121.00	23.6	20.1	.1	-12.4	.1	4
40.	95.	15.0800	123.55	23.9	20.0	.1	-13.2	.3	4
40.	95.	15.1000	125.11	24.0	19.7	.0	-13.8	.3	4
40.	95.	15.1200	127.21	24.7	19.7	.3	-14.9	.2	4
40.	95.	15.1400	128.81	25.2	19.6	.5	-15.8	.4	4
40.	95.	15.1600	[illegible]	25.6	[illegible]	.6	-16.3	.3	4
40.	95.	15.1800	[illegible]	25.9	19.6	.7	-17.0	.7	4
40.	95.	15.2000	130.75	22.7	17.2	.4	-14.8	.5	4
40.	95.	15.2200	[illegible]	20.4	15.7	.1	-13.0	.1	4
40.	95.	15.2400	131.20	20.5	15.4	.2	-13.5	.2	4
40.	95.	15.2600	130.44	19.1	14.5	.1	-12.4	.3	4
40.	95.	15.2800	129.87	18.7	14.3	.1	-12.0	.1	4
40.	95.	15.3000	[illegible]	18.2	13.9	[illegible]	-11.7	.2	4
40.	95.	15.3200	123.11	17.8	13.8	.0	-11.2	.3	4
40.	95.	15.3400	[illegible]	17.3	[illegible]	.0	-10.8	.1	4
40.	95.	15.3600	125.40	17.4	13.9	.0	-10.4	.1	4
40.	95.	15.3800	127.26	17.4	13.9	.0	-10.5	.1	4
40.	95.	15.4000	[illegible]	17.5	[illegible]	.0	-10.7	.2	4
40.	95.	15.4200	125.02	17.1	13.8	.0	-10.0	.2	4
40.	95.	15.4400	124.19	16.7	13.8	.0	-9.4	.1	4
40.	95.	15.4600	124.43	16.8	13.8	.0	-9.6	.1	4
40.	95.	15.4800	[illegible]	17.0	[illegible]	.0	[illegible]	.1	4

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEW M/S		VNS M/S		NP
40.	95.	18.4200	160.98	9.8	3.2	.6	-9.3	.2	4
40.	95.	18.4400	162.73	9.9	2.9	.6	-9.5	.3	4
40.	95.	18.4600	164.15	10.2	2.6	.6	-9.6	.5	4
40.	95.	18.4800	165.70	11.2	2.8	.6	-10.2	.9	4
40.	95.	18.5000	167.35	11.9	2.6	.7	-11.6	1.0	4
40.	95.	18.5200	168.54	13.2	2.6	1.2	-12.9	1.3	4
40.	95.	18.5400	170.48	13.6	2.2	1.4	-13.4	.9	4
40.	95.	18.5600	172.43	13.9	1.8	1.9	-13.8	1.1	4
40.	95.	18.5800	173.65	14.0	1.6	1.[illegible]	-14.7	1.4	4
40.	95.	18.6000	174.67	15.7	1.5	2.0	-15.6	1.9	4
40.	95.	18.6200	175.72	16.7	1.2	1.9	-16.6	2.3	4
40.	95.	18.6400	176.65	17.7	1.0	1.0	-17.7	2.4	4
40.	95.	18.6600	177.47	18.6	.8	1.[illegible]	-18.6	2.6	4
40.	95.	18.6800	178.51	19.5	.6	1.7	-19.5	3.2	4
40.	95.	18.7000	179.09	20.6	.3	1.4	-20.6	3.7	4
40.	95.	18.7200	179.86	21.5	.1	1.2	-21.5	3.6	4
40.	95.	18.7400	180.42	22.2	-.3	1.0	-22.2	3.9	4
40.	95.	18.7600	181.61	22.[illegible]	-.6	.[illegible]	-22.[illegible]	4.0	4
40.	95.	18.7800	215.13	7.7	-4.4	.0	-6.3	.1	4
40.	95.	18.8000	215.37	7.8	-4.5	.0	-6.3	.1	4
40.	95.	18.8200	213.11	8.1	-4.4	.1	-6.8	.1	4
40.	95.	18.8400	212.45	8.3	-4.4	.1	-7.0	.1	4
40.	95.	18.8600	214.01	8.5	-4.8	.2	-7.0	.6	4
40.	95.	18.8800	220.26	8.3	-5.4	.1	-6.3	.5	4
40.	95.	18.9000	250.51	4.3	-4.1	.3	-1.4	.3	4
40.	95.	18.9200	241.30	4.4	-3.9	.1	-2.1	.1	4
40.	95.	18.9400	231.[illegible]7	4.7	-3.7	.1	-2.9	.1	4
40.	95.	18.9600	227.11	4.8	-3.5	.1	-3.3	.1	4
40.	95.	18.9800	225.59	4.8	-3.5	.1	-3.4	.1	4
40.	95.	19.0000	223.51	4.9	-3.4	.4	-3.6	.0	4
40.	95.	19.0200	224.74	4.8	-3.4	.0	-3.4	.1	4
40.	95.	19.0400	229.70	4.6	-3.5	.0	-3.0	.2	4
40.	95.	19.0600	240.19	4.2	-3.8	.0	-1.7	.2	4
40.	95.	19.0800	267.14	3.6	-3.4	.1	1.1	.2	4
40.	95.	19.1000	279.75	3.5	-3.5	.1	.6	.2	4
40.	95.	19.1200	270.36	3.6	-3.6	.1	.0	.2	4
40.	95.	19.1400	260.76	3.8	-3.7	.1	-.6	.2	4
40.	95.	19.1600	250.49	4.1	-3.8	.2	-1.4	.2	4
40.	95.	19.1800	241.51	4.5	-4.0	.2	-2.1	.2	4
40.	95.	19.2000	234.20	5.0	-4.1	.2	-2.5	.2	4
40.	95.	19.2200	227.54	5.6	-4.1	.3	-3.8	.1	4
40.	95.	19.2400	221.08	6.3	-4.2	.2	-4.7	.1	4
40.	95.	19.2600	216.78	7.0	-4.2	.2	-5.6	.1	4
40.	95.	19.2800	212.50	7.8	-4.2	.2	-6.6	.2	4
40.	95.	19.3000	20[illegible].74	8.7	-4.1	.1	-7.7	.2	4
40.	95.	19.3200	204.95	9.6	-4.0	.1	-8.7	.1	4
40.	95.	19.3400	202.24	10.4	-4.0	.2	-9.7	.2	4
40.	95.	19.3600	201.43	11.2	-4.1	.4	-10.4	.3	4
40.	95.	19.3800	199.36	12.0	-4.1	.4	-11.3	1.2	4
40.	95.	19.4000	199.49	12.5	-4.2	.3	-11.8	1.2	4
40.	95.	19.4200	199.57	12.7	-4.2	.3	-11.9	1.2	4
40.	95.	19.4400	221.[illegible]4	8.6	-5.6	.0	-6.5	.1	4
40.	95.	19.4600	224.08	8.4	-5.8	.0	-6.0	.1	4
40.	95.	19.4800	226.[illegible]5	8.5	-6.0	.0	-6.0	.0	4
40.	95.	19.5000	226.63	8.6	-6.2	.1	-5.9	.1	4
40.	95.	19.5200	225.59	9.0	-6.4	.1	-6.3	.2	4
40.	95.	19.5400	232.[illegible]	8.9	-7.1	.1	-5.4	.1	4
40.	95.	19.5600	236.90	9.0	-7.4	.1	-5.2	.2	4
40.	95.	19.5800	242.45	8.6	-7.6	.0	-4.0	.1	4
40.	95.	19.6000	244.24	8.5	-7.6	.0	-3.7	.0	4
40.	95.	19.6200	244.65	8.5	-7.7	.0	-3.6	.0	4
40.	95.	19.6400	245.59	8.5	-7.8	.0	-3.6	.1	4
40.	95.	19.6600	249.40	8.6	-8.0	.0	-3.1	.1	4
40.	95.	19.6800	260.35	8.4	-8.3	.0	-1.4	.1	4
40.	95.	19.7000	260.63	8.5	-8.4	.0	-1.4	.0	4
40.	95.	19.7200	261.22	8.6	-8.5	.0	-1.8	.0	4
40.	95.	19.7400	259.84	8.8	-9.6	.0	-1.5	.1	4
40.	95.	19.7600	265.37	8.1	-8.0	.1	-.7	.5	4
40.	95.	19.7800	272.55	6.9	-6.9	.1	.3	.2	4
40.	95.	19.8000	267.64	6.8	-6.6	.1	-.3	.1	4
40.	95.	19.8200	262.49	6.7	-6.6	.1	-.9	.1	4
40.	95.	19.8400	257.43	6.[illegible]	-6.6	.1	-1.5	.1	4
40.	95.	19.8600	252.32	6.9	-6.5	.1	-2.1	.1	4

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEW M/S		VNS M/S		NP
40.	95.	19.[illegible]	245.[illegible]	6.9	-6.3	.1	-2.8	.1	4
40.	95.	19.9000	243.2[illegible]	7.2	-6.5	.1	-3.3	.0	4
40.	95.	19.9200	239.91	7.4	-6.4	.1	-3.7	.1	4
40.	95.	19.9400	237.27	7.7	-6.4	.1	-4.1	.1	4
40.	95.	19.9600	231.17	7.9	-6.1	.0	-4.9	.1	4
40.	95.	19.9800	227.38	8.2	-6.0	.1	-5.6	.5	4
40.	95.	20.0000	244.[illegible]1	6.2	-7.4	.0	-3.5	.1	4
40.	95.	20.0200	250.19	6.1	-7.6	.0	-2.8	.1	4
40.	95.	20.0400	266.14	7.5	-7.5	.0	-.5	.1	4
40.	95.	20.0600	266.19	7.3	-7.3	.0	-.5	.1	4
40.	95.	20.0800	264.5[illegible]	7.2	-7.1	.0	-.7	.1	4
40.	95.	20.1000	267.48	6.9	-6.9	.0	-.2	.1	4
40.	95.	20.1200	266.72	7.1	-7.1	.0	-.4	.1	4
40.	95.	20.1400	263.65	7.2	-7.1	.0	-.6	.0	4
40.	95.	20.1600	260.52	7.3	-7.2	.0	-1.2	.0	4
40.	95.	20.1800	259.64	7.4	-7.3	.0	-1.3	.2	4
40.	95.	20.2000	268.35	7.2	-7.2	.0	-.2	.0	4
40.	95.	20.2200	272.15	6.8	-6.8	.1	.3	.1	4
40.	95.	20.2400	277.27	6.2	-6.2	.1	.8	.1	4
40.	95.	20.2600	276.16	5.[illegible]	-5.7	.1	.6	.0	4
40.	95.	20.2800	274.19	5.4	-5.4	.1	.4	.1	4
40.	95.	20.3000	273.02	5.2	-5.2	.1	.3	.1	4
40.	95.	20.3200	273.79	4.7	-4.7	.1	.3	.0	4
40.	95.	20.3400	274.70	4.4	-4.4	.0	.4	.1	4
40.	95.	20.3600	267.62	4.3	-4.3	.0	-.2	.1	4
40.	95.	20.3800	260.[illegible]3	4.5	-4.5	.1	-.8	.1	4
40.	95.	20.4000	253.44	4.9	-4.7	.1	-1.4	.0	4
40.	95.	20.4200	249.[illegible]1	5.1	-4.8	.0	-1.8	.1	4
40.	95.	20.4400	244.41	5.3	-4.[illegible]	.1	-2.3	.2	4
40.	95.	20.4600	240.00	5.5	-4.8	.0	-2.8	.1	4
40.	95.	20.4800	234.57	5.9	-4.8	.0	-3.4	.7	4
40.	95.	20.5000	254.[illegible]	5.1	-4.9	.0	-1.3	.0	4
40.	95.	20.5200	250.24	5.2	-4.9	.0	-1.[illegible]	.1	4
40.	95.	20.5400	244.[illegible]	5.4	-4.8	.0	-2.3	.1	4
40.	95.	20.5600	239.94	5.7	-4.9	.0	-2.8	.1	4
40.	95.	20.5800	235.31	6.0	-4.9	.1	-3.4	.1	4
40.	95.	20.6000	234.[illegible]1	6.3	-5.1	.2	-3.6	.6	4
40.	95.	20.6200	261.[illegible]	6.1	-6.0	.1	-.9	.5	4
40.	95.	20.6400	284.79	4.9	-4.7	.1	1.3	.1	4
40.	95.	20.6600	291.35	4.2	-3.9	.1	1.6	.1	4
40.	95.	20.6800	303.2[illegible]	3.6	-3.[illegible]	.2	2.0	.0	4
60.	95.	20.7000	308.07	2.7	-2.1	.0	1.6	.0	3
60.	95.	20.7200	2[illegible].34	2.6	-2.3	.1	1.3	.1	3
60.	95.	20.7400	285.58	2.4	-2.3	.1	.7	.0	3
60.	95.	20.7600	284.11	2.1	-2.1	.0	.5	.1	3
60.	95.	20.7800	275.[illegible]6	1.7	-1.7	.0	.2	.0	3
60.	95.	20.8000	26[illegible].72	1.3	-1.3	.0	-.0	.0	3
60.	95.	20.8200	250.22	1.2	-1.1	.0	-.3	.0	3
60.	95.	20.8400	233.18	2.2	-1.7	.1	-1.3	.1	3
60.	95.	20.8600	223.4[illegible]	3.1	-2.1	.1	-2.2	.0	3
60.	95.	20.8800	221.90	3.6	-2.4	.0	-2.7	.0	3
60.	95.	20.9000	220.37	4.0	-2.6	.1	-3.0	.1	3
60.	95.	20.9200	220.33	4.4	-2.9	.1	-3.4	.0	3
60.	95.	20.9400	218.78	4.9	-3.1	.0	-3.8	.1	3
60.	95.	20.9600	217.35	5.4	-3.2	.0	-4.3	.1	3
60.	95.	20.9800	214.25	6.0	-3.4	.1	-4.9	.2	3
60.	95.	21.0000	209.43	6.7	-3.3	.1	-5.8	.2	3
60.	95.	21.0200	207.47	7.3	-3.4	.1	-6.5	.2	3
60.	95.	21.0400	203.[illegible]	[illegible]	-3.3	.0	-7.3	.2	3
60.	95.	21.0600	200.78	8.9	-3.2	.2	-[illegible].3	.0	3
60.	95.	21.0800	197.26	10.0	-2.9	.3	-9.6	.0	3
60.	95.	21.1000	193.26	12.0	-2.8	.5	-11.7	.4	3
60.	95.	21.1200	191.31	14.2	-2.9	.5	-13.9	.3	3
60.	95.	21.1400	192.50	15.3	-3.3	.4	-15.0	1.0	3
60.	95.	21.1600	191.21	15.[illegible]	-3.1	.5	-15.6	1.1	3
60.	95.	21.1800	190.57	16.9	-3.1	.5	-16.6	1.1	3
60.	95.	21.2000	189.71	17.6	-3.0	.5	-17.3	1.2	3
60.	95.	21.2200	187.63	19.[illegible]	-2.5	.6	-1[illegible]	1.2	3
60.	95.	21.2400	186.73	20.8	-2.5	.7	-20.7	1.[illegible]	3
60.	95.	21.2600	239.50	10.2	-8.7	.0	-5.2	.0	3
60.	95.	21.2800	238.74	10.2	-8.8	.0	-5.3	.2	3
60.	95.	21.3000	237.90	10.4	-8.8	.0	-5.5	.3	3
60.	95.	21.3200	245.76	9.2	-8.4	.0	-3.8	.1	3

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEW M/S		VNS M/S		NP
60.	95.	21.3400	243.13	9.0	-8.0	.0	-4.1	.1	3
60.	95.	21.3600	243.37	8.8	-7.9	.0	-4.0	.1	3
60.	95.	21.3800	240.46	9.0	-7.8	.0	-4.4	.1	3
60.	95.	21.4000	23[illegible]	9.2	-7.[illegible]	.0	-4.7	.0	3
60.	95.	21.4200	236.41	9.4	-7.9	.0	-5.2	.1	3
60.	95.	21.4400	236.[illegible]	9.4	-7.8	.0	-5.2	.2	3
60.	95.	21.4600	241.51	9.2	-8.1	.0	-4.4	.3	3
60.	95.	21.4800	242.55	9.4	-8.3	.0	-4.3	.2	3
60.	5.	21.5000	250.[illegible]	9.2	-8.7	.0	-3.0	.2	3
60.	95.	21.5200	256.34	8.7	-8.5	.0	-2.1	.0	3
60.	95.	21.5400	254.57	8.6	-8.3	.0	-2.3	.1	3
60.	95.	21.5600	253.[illegible]3	8.7	-8.3	.0	-2.6	.1	3
60.	95.	21.5800	251.36	8.6	-8.2	.0	-2.[illegible]	.0	3
60.	95.	21.6000	249.34	8.6	-8.1	.0	-3.1	.1	3
60.	95.	21.6200	246.84	8.7	-8.0	.0	-3.4	.1	3
60.	95.	21.6400	245.74	8.7	-8.[illegible]	.0	-3.6	.0	3
60.	95.	21.6600	245.30	8.7	-7.9	.0	-3.6	.1	3
60.	95.	21.6800	24[illegible].54	8.4	-7.[illegible]	.0	-2.9	.1	3
60.	95.	21.7000	252.98	8.3	-7.9	.0	-2.4	.1	3
60.	95.	21.7200	254.54	8.4	-8.1	.0	-2.2	.1	3
60.	95.	21.7400	271.2[illegible]	8.5	-8.5	.0	.2	.0	3
60.	95.	21.7600	276.22	8.5	-8.4	.0	.[illegible]	.2	3
60.	95.	21.7800	282.62	8.4	-8.2	.0	1.9	.0	3
60.	95.	21.8000	290.21	8.0	-7.5	.0	2.8	.0	3
60.	95.	21.8200	290.[illegible]1	7.6	-7.3	.0	2.6	.2	3
60.	95.	21.8400	287.48	7.6	-7.2	.0	2.3	.1	3
60.	.5.	21.[illegible]600	2[illegible]6.[illegible]1	7.3	-7.0	.0	2.1	.0	3
60.	95.	21.8800	285.17	7.2	-7.0	.0	1.9	.0	3
60.	95.	21.9000	279.30	7.2	-7.1	.[illegible]	1.2	.0	3
60.	95.	21.9200	272.35	7.4	-7.4	.1	.3	.2	3
60.	95.	21.9400	26[illegible].35	7.[illegible]	-7.[illegible]	.1	-.3	.1	3
60.	95.	21.9600	267.00	7.7	-7.7	.1	-.3	.0	3
60.	95.	21.9800	264.56	7.5	-7.4	.1	-.7	.0	3
60.	95.	22.0000	264.44	7.4	-7.3	.0	-.7	.1	3
60.	95.	22.0200	258.25	7.2	-7.0	.0	-1.5	.0	3
60.	95.	22.0400	251.35	7.1	-6.7	.0	-2.3	.0	3
60.	95.	22.0600	247.17	7.1	-6.6	.0	-2.8	.0	3
60.	95.	22.0800	240.23	7.3	-6.4	.0	-3.6	.3	3
60.	95.	22.1000	247.79	7.1	-6.6	.0	-2.7	.2	3
60.	95.	22.1200	251.[illegible]	6.9	-6.6	.0	-2.2	.1	3
60.	95.	22.1400	249.79	7.2	-6.8	.0	-2.5	.1	3
60.	95.	22.1600	250.70	7.4	-7.0	.0	-2.4	.0	3
60.	95.	22.1[illegible]	240.61	7.5	-7.[illegible]	.0	-2.7	.1	3
60.	95.	22.2000	247.35	7.7	-7.1	.0	-3.0	.1	3
60.	5.	22.2200	244.54	7.[illegible]	-7.1	.0	-3.4	.1	3
60.	95.	22.2400	241.[illegible]3	8.4	-7.3	.0	-4.0	.1	3
60.	95.	22.2600	233.[illegible]0	8.7	-7.5	.0	-4.5	.1	3
60.	95.	22.2800	241.[illegible]0	8.6	-7.5	.0	-4.2	.1	3
60.	.5.	22.3000	240. 7	[illegible]	-7.7	.0	-4.3	.1	3
60.	95.	22.3200	243.18	9.1	-8.1	.0	-4.1	.2	3
60.	95.	22.3400	246.50	9.1	-8.3	.0	-3.6	.1	3
60.	95.	22.3600	249.[illegible]5	9.3	-8.7	.0	-3.3	.2	3
60.	95.	22.3800	249.79	9.3	-8.7	.0	-3.2	.1	3
60.	95.	22.4000	250.14	9.4	-8.8	.1	-3.2	.1	3
60.	95.	22.4200	248.07	9.7	-9.0	.1	-3.6	.1	3
60.	95.	22.4400	248.27	10.4	-9.7	.1	-3.9	.1	3
60.	95.	22.4600	246.[illegible]	11.1	-10.2	.0	-4.5	.3	3
60.	.5.	22.4[illegible]00	256.17	10.[illegible]	-10.6	.0	-2.6	.2	3
60.	95.	22.5000	258.09	10.9	-10.7	.1	-2.3	.4	3
60.	95.	22.5200	270.40	9.7	-9.7	.0	.1	.2	3
60.	95.	22.5400	269.69	9.3	-9.[illegible]	.0	-.1	.1	3
60.	95.	22.5600	266.74	9.2	-9.1	.0	-.5	.1	3
60.	.5.	22.5800	266.40	8.6	-8.5	.0	-.5	.1	3
60.	95.	22.6000	262.54	8.5	-8.5	.0	-1.1	.1	3
60.	95.	22.6200	260.24	8.5	-8.3	.0	-1.4	.1	3
60.	95.	22.6400	257.48	8.4	-8.2	.0	-1.8	.0	3
60.	.5.	22.6600	256.42	[illegible].5	-[illegible].3	.0	-2.0	.1	3
60.	95.	22.6800	253.91	8.5	-8.2	.0	-2.4	.1	3
60.	95.	22.7000	261.27	8.5	-8.4	.1	-1.3	.3	3
60.	95.	22.7200	27[illegible].5[illegible]	7.[illegible]	-7.7	.0	1.3	.1	3
60.	95.	22.7400	280.00	7.8	-7.6	.0	1.4	.1	3
60.	5.	22.7600	277.85	7.8	-7.7	.0	2.1	.1	3
60.	95.	22.7800	276.94	7.8	-7.7	.0	.9	.1	3

TIME SECS	TIME SECS	ALT KM	AZ DEG	VEL M/S	VEW M/S		VNS M/S		NP
60.	95.	22.8000	278.[illegible]9	7.8	-7.7	.0	1.1	.3	3
60.	95.	22.8200	275.52	7.[illegible]	-7.[illegible]	.0	1.3	.1	3
60.	95.	22.8400	278.61	8.1	-8.0	.0	1.2	.1	3
60.	95.	22.8600	277.30	8.3	-8.2	.0	1.1	.1	3
60.	95.	22.8800	276.[illegible]3	8.4	-8.3	.0	1.0	.2	3
60.	95.	22.9000	278.2[illegible]	8.6	-8.4	.0	[illegible]	.2	3
60.	95.	22.9200	280.27	8.5	-8.4	.0	1.5	.0	3
60.	95.	22.9400	277.51	8.7	-8.7	.0	1.1	.2	3
60.	95.	22.9600	270.54	[illegible]	-8.7	.0	1.0	.1	3
60.	95.	22.9800	277.32	8.8	-8.8	.0	1.2	.1	3
60.	95.	23.0000	274.5[illegible]	9.1	-[illegible].1	.0	.7	.0	3
60.	95.	23.0200	287.17	8.6	-8.2	.0	2.5	.2	3
60.	95.	23.0400	284.09	8.2	-8.0	.0	2.[illegible]	.1	3
60.	95.	23.0600	276.09	7.9	-7.9	.0	.9	.1	3
60.	95.	23.0800	273.75	7.7	-7.7	.0	.5	.1	3
60.	95.	23.1000	274.09	7.2	-7.2	.0	.5	.1	3
60.	95.	23.1200	274.74	6.9	-6.9	.0	.6	.1	3
60.	95.	23.1400	273.[illegible]7	6.5	-6.5	.0	.4	.2	3
60.	95.	23.1600	270.71	6.4	-6.4	.0	.1	.1	3
60.	95.	23.1800	267.40	6.3	-6.3	.0	-.3	.1	3
60.	95.	23.2000	271.49	6.0	-6.0	.0	.2	.1	3
60.	95.	23.2200	271.39	5.8	-5.8	.0	.2	.1	3
60.	95.	23.2400	265.41	5.9	-5.9	.0	-.2	.0	3
60.	95.	23.2600	264.[illegible]2	6.3	-6.2	.0	-.6	.1	3
60.	95.	23.2800	260.57	6.5	-6.4	.0	-1.1	.1	3
60.	95.	23.3000	255.25	7.0	-6.8	.0	-1.8	.0	3
60.	95.	23.3200	240.66	7.7	-7.2	.0	-2.[illegible]	.0	3
60.	95.	23.3400	243.94	8.4	-7.5	.0	-3.7	.0	3
60.	95.	23.3600	243.17	8.6	-7.7	.0	-3.9	.1	3
60.	95.	23.3800	241.29	9.0	-7.9	.0	-4.3	.1	3

ALTS= 468 V-E ERROR = .1550 V-N ERROR = .2576

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